The National Numeracy Strategy and primary teacher confidence as perceived by teachers

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Abstract.

The National Numeracy Strategy aimed to increase pupil achievement in mathematics. To that end the Task Force noted, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy." (Numeracy Task Force 1998, p.2) This emphasized: the importance of confidence as one of two key elements; the fact that teachers lack confidence; and the need to increase confidence quickly.

Despite highlighting the importance, the need and the urgency, however, no definition is provided with regard to what confidence is. Furthermore, whilst the government believe it to be so, teachers will not necessarily be in agreement. This work therefore inquired, by way of three questionnaires and two focus group discussions, into primary teacher perceptions of confidence in mathematics. It aimed to define from a range of views what the teachers believe confidence to be, how they see it manifested, what it affects, what affects it, whether it is important, whether it is lacking and if so, why.

The teachers report that they believe confidence affects how they teach, how they perceive their teaching, and pupil attitude and achievement. They define confidence in terms of secure subject knowledge, sound teaching and a positive attitude – reflecting what they know, how they use their knowledge and how they feel – and linking confidence and competence closely. They attribute a lack of confidence to insecure subject knowledge and their own experiences at school. Whilst welcoming the strategy and believing it to be necessary, most report that it has not altered their beliefs and values. Although acknowledging an increase in confidence, the teachers report that they believe it is still lacking.

The National Numeracy Strategy and Primary Teacher Confidence as Perceived by Teachers.

List of Tables:

Appendices:

Chapter 1: The introduction.

The aim of this research is to inquire into the question of teacher confidence in primary mathematics. By examining a range of views and opinions expressed by a small sample of teachers, and by considering the implications of those views in terms of mathematical practice, this work aims to explain teacher perceptions with regard to teachers' confidence in mathematics. These opinions are expressed in written and verbal form, by way of three written questionnaires (appendices i, iii & v) and two focus group discussions (see 5.2e below). In this way, this research seeks to add to the existing knowledge base on the question of primary teacher confidence in mathematics. The justification for this inquiry arises from the introduction of the National Numeracy Strategy (see Ch. 3 below), a new initiative for the teaching of mathematics, in which the government highlights teacher confidence and competence as the two key factors for greater teaching effectiveness and for improved levels of pupil learning. This is demonstrated in the Final Report of the Numeracy Task Force (1998), which notes, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy" (p.2). This focus, accepted in full by the Secretary of State for Education, brings the question of teacher confidence in primary mathematics to the fore.

1.1 The aim of this research work.

In addressing the question of primary teacher confidence this research aims to define on the basis of a range of views, expressed by the teachers in written and verbal form –

- what they believe confidence to be;

- whether, and if so the degree to which, they feel confidence important to their practice;
- how they believe confidence affects their practice – in terms of how they feel about mathematics, how they teach, how they perceive their teaching, and how their confidence affects pupil learning.

As the Final Report of the Task Force (Numeracy Task Force 1998) points not only to the importance of confidence but also the need to increase levels of teacher confidence in mathematics quickly, this work also seeks to inquire as to whether the teachers –

- believe this focus to be necessary;
- believe they lack confidence, and if so, the degree to which they perceive that lack;
- and why.

In addition, given that the government provides a programme of training and support allocated alongside the National Numeracy Strategy (see 3.3 below), a means through which confidence and competence can be built-up, this work also assesses –

- what the teachers believe the impact of the National Numeracy Strategy on confidence to be, with regard to training and implementation.

1.2 The area of research.

The government, through acceptance by the Secretary of State of the Final Report of the Numeracy Task Force (Numeracy Task Force 1998), brought the question of teacher confidence to the fore. In so doing they took on-board and accepted the fact that confidence is important to mathematical practice and pupil learning. They emphasised the fact that teachers lack confidence, that they need greater confidence

and that they need it quickly, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy" (Numeracy Task Force 1998, p.2). Despite noting the importance of confidence, the need to increase it and the urgency of doing so quickly, however, no indication was given as to what confidence is – what it comprises or how it is manifest in the classroom. The Preliminary Report (Numeracy Task Force 1998a), the Final Report (Numeracy Task Force 1998), the Framework for Teaching Mathematics (DfEE 1999) and the associated literature, failed to define what they understand confidence to be. Furthermore, little evidence was presented to explain this lack of confidence, how it was determined, from whence it stemmed or the level at which it was assessed. Indeed despite the key importance stated, a number of fundamental questions with regard to confidence and its effect on mathematics teaching and learning were left unanswered. These include basic questions such as, what is confidence, how is confident teaching manifest, what does confidence affect and what affects it?

Given this focus and the key nature of confidence outlined therein, in failing to define what it understands confidence to be the Task Force and government leave a fundamental question open to interpretation. This perhaps arises from an assumption that all teachers will universally and fully understand what is meant, in terms of their own mathematics and their teaching. But can it be assumed that such is the case? Do all teachers take the same or even vaguely similar meanings? Will confidence have the same significance for, for example, the experienced and the inexperienced teacher, or the confident and less confident teacher, in terms of how they teach, how they perceive their teaching or how they feel about the subject? Will each see confidence manifest in similar ways, or will manifestation also be determined by

other factors such as the class they teach, the age range, available resources, the subject knowledge of the teacher, her attitude or experience? Indeed, does confidence have any real significance outside of the Task Force focus?

The Preliminary Report notes, "Teachers who are confident about the mathematics they teach and are enthusiastic and effective, stimulate pupils' interest in the subject." (Numeracy Task Force 1998a, p.9) What factors, however, contribute to this confident feeling? Is it the existence of secure connected subject knowledge, a combination of particular mathematical skills, certain approaches, the adoption of a particular philosophy of mathematics education, a good supply of resources, or a deep understanding and appreciation of the subject? Is it gained through experience, built up over time? Is it any one, a combination, or indeed all? No evidence or further explanation is presented alongside the statement. This lack of definition clearly holds certain implications, given the difficulty of successfully increasing confidence levels without first having identified those attributes that contribute to confidence. A further factor concerns the implementation of a new strategy. The National Numeracy Strategy outlines changes at almost all levels, incorporating content, lesson structure, approaches, planning and teaching strategies. It is also based upon and promotes a particular philosophy of mathematics education (see Ch. 3 below). Given such major change, not only to what is being taught but also to how, can confidence be even maintained at existing levels never mind increased at such a time?

1.3 The rationale.

As with most initiatives, the National Numeracy Strategy arose from a desire by government to raise levels of pupil achievement in mathematics (see Ch. 2 below). The Preliminary Report notes, "we also want teachers and pupils to be confident and

positive towards the subject" (Numeracy Task Force 1998a, p.9). To that end, "The main focus of the Task Force's work has therefore inevitably been at the level of teachers' individual effectiveness, as this will make the crucial difference to individual pupils' achievement in numeracy" (p.12). The Final Report identified two key elements in achieving this, and also therefore two key areas for development, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy." (Numeracy Task Force 1998, p.2) There are three issues inherent in this statement:

i. the importance of confidence to effective practice and to increased levels of pupil achievement - noting a specific direction and purpose with regard to increasing teachers' individual effectiveness;
ii. the need, rather than the wish or desire, to increase confidence;
iii. the urgency of doing so quickly, emphasising its importance to the successful implementation of the strategy.

The fact that the government believe it to be so does not, however, necessarily make it so. It cannot be assumed that teachers will automatically be in agreement, with regard to all or any of this statement. They may not, for example, believe confidence to be a key element within their practice. They could view it simply as a factor highlighted in the latest initiative and therefore likely to change with a new government, important in a political but not a practical teaching sense. Even if they do feel it to be important, they may not believe it to be lacking, nor to be an urgent need. Either way, given that the teacher is the key to higher levels of pupil achievement (Marino 1998), that it is she who is ultimately present within the classroom, and that the quality of pupil learning has been shown to depend upon the degree of her

effectiveness (OFSTED 1997, Numeracy Task Force 1998) – all of which will be discussed during the course of his work - the views, beliefs and values to which she holds cannot and should not be ignored.

1.4 Personal interest.

In deciding on a research question for this work and given the particular timing, I aimed to inquire into an area connected to National Numeracy Strategy implementation, but a question with direct relevance to teachers. With a background of fifteen years in primary teaching, the choice of this particular research question arose from a combination of factors. First was the Task Force and government focus highlighting teacher confidence alongside competence as the two key factors for greater teaching effectiveness and higher pupil achievement in mathematics. Despite emphasising the importance of confidence, the Final Report (Numeracy Task Force 1998) provided no definition as to what it understood confidence to be, presented little evidence of a lack of confidence, and as already seen, left many key fundamental questions unanswered. As these questions concerned basic issues they deserved and needed to be addressed.

A second factor contributing to this decision was limits emerging within the literature. These became apparent from a very early stage in the research process. Unlike competence where the literature was already fairly extensive, I was aware at the outset of little recorded on the question of teacher confidence in primary mathematics, by comparison. Confirmation of this was quickly received through the searches. The anomaly that it presented, however, was somewhat intriguing in itself – highlighted by the Task Force and government as one of two key factors for greater effectiveness in mathematics teaching, yet an area in which it appeared

limited research had previously been undertaken. Regardless, however, of apparent limitations within the literature at the outset, I still expected that more would be identified during the course of the research work. This could be recorded perhaps with regard to confidence and mathematics (not primary specific) or even confidence and teaching generally. I also expected that in light of the stated importance, further writings might emerge in line with the introduction of the National Numeracy Strategy, published alongside through associated paperwork. Notwithstanding, it was possible that gaps might emerge within the existing knowledge base during the course of this research.

A third factor contributing to the decision to inquire into this particular question stemmed from the teachers themselves. I was aware from my own experiences in teaching that some teachers viewed research as often having little relevance to them and to their classroom practice. I was aware that some feel they are not consulted on issues directly affecting them, and that some feel dictated to rather than listened to. Given the importance placed on confidence by the Task Force, an importance accepted by the government, and given that this question affected teachers directly, incorporating possibly how they feel about the subject and their teaching of it, I was interested to pose the question directly. Although only a small-scale qualitative study seeking to provide a range of views rather than generalising on a large scale, I felt that the results could still prove interesting in explaining how teachers conceptualise confidence. They could add to the existing knowledge base and possibly even lead to further research on a larger scale at a later point in time (see 9.10 below).

One final factor affecting this choice stemmed from the memory of informal conversations with primary teachers dating back many years. These discussions had

addressed the question of teacher attitude, the importance of that attitude to teaching, to how the teachers perceive their teaching and to how they feel about the subject. Whilst the discussions had been primarily concerned with the teaching of music, considering why teachers tend not to have a positive and confident attitude in their teaching of it, mathematics had been put forward during the discussion by one of the teachers. It was raised as an example of another subject area in which she felt confidence was lacking. This was recalled to mind when faced with the Numeracy Task Force focus. Therefore, given a combination of these factors, I chose to inquire further.

1.5 A chapter overview.

The aim of this research is to explain how teachers conceptualise confidence. To that end this work examines a range of views, expressed by way of questionnaire and focus group discussion, on the question of teacher confidence in mathematics. Following on from this introductory chapter, this work is structured as follows:

Chapter two:

Chapter two traces the background to the National Numeracy Strategy, outlining the historical context from which the strategy and the Numeracy Task Force focus emerge. In so doing it outlines changes since the 1950's, including the introduction of the modern mathematics system in the 1960's and the implementation of a national curriculum in 1989. This is important as past experiences can warn of some of the things ahead. It also allows comparisons to be drawn between requirements pre and post National Numeracy Strategy implementation, highlighting the degree of change required by teachers with regard to what and how they are teaching. In

addition, it shows the educational context from which the teachers responding to this research themselves emerged. This could prove significant were they to identify their own mathematics education as a factor affecting their confidence, affecting their attitude towards mathematics and affecting how they teach.

Chapter three:

Chapter three examines the National Numeracy Strategy itself, looking at content, structure, approach, planning and philosophy. In so doing it determines the context in which teacher confidence is expected to grow. It also outlines the changes required to practice - including the adoption of a particular philosophy of mathematics education based upon certain beliefs, values, needs and expectations. This could have implications were a connection found to exist between the beliefs, confidence and ability of the teacher to adopt change into practice. This chapter also details the programme of training, designed to prepare teachers for implementation and to build-up confidence and competence at the beginning of the strategy. Allocated by government to address the problem perceived, an examination of this standard three-day training programme allows some indication of the scale of the lack, reflected in the course of action undertaken.

Chapter four:

Chapter four explores confidence through the literature, seeking to refine and redefine the research questions prior to an examination of teachers' views on this question. Given that no definition is provided within the two Task Force reports (Numeracy Task Force 1998 & 1998a), the Framework for Teaching Mathematics (DfEE 1999) or associated publications, chapter four inquires into what confidence is, what contributes

to confident teaching, what confidence affects and what affects it. It also, given the introduction of a new strategy incorporating a particular way of teaching, addresses the question of confidence in the implementation of curricular and philosophical change - given the importance of taking on-board the entire package and with evidence that not all recommended changes and good advice have in the past been incorporated universally into practice (see Ch. 2 below). Finally it looks at the question of teacher beliefs, given that this work centres on what teachers believe about confidence.

Chapter five:

Chapter five sets out the methodology for this research. It is approached by way of three sections - the research design, the collection of data, and the analysis of data. The first section explains the general approach, what decisions were made and why. It outlines the research plan and the timescale. It also describes the research question and considers any limitations or problems encountered during the research process. Section two addresses the collection of data. It summarises the courses I attended by way of preparation and discusses the form of data collection, setting down that chosen as most appropriate to this particular question and why it was chosen. It explains how the three questionnaires were drawn up, in terms of what was included and why, and how each differs from the other given the need to address what was required. The sample and distribution is also outlined. It also describes procedures for the focus group discussions, looking at the stimulus, context and those attending. Finally, section two lists the steps taken to ensure reliability and validity in the collection of the data. Section three describes the analysis of the data. It explains the procedures for sorting, ordering and tabulating the data. It also outlines how the findings were validated through questionnaire 3 and the focus group discussions.

Chapters six, seven and eight:

These three chapters comprise the main data chapters, recording the responses of the teachers to the three questionnaires and the two focus group discussions. Questionnaire 1 (appendix i) was undertaken one-term pre-National Numeracy Strategy implementation. It gives up mainly numerical data. The open-ended items of questionnaire 2 (appendix iii), undertaken one-term post strategy implementation provide mainly qualitative data. Questionnaire 3 (appendix v) gives up both quantitative and qualitative data one-year on, whilst the focus group discussions provide validation for the emerging conclusions. Throughout, informal discussions were undertaken with teachers. These acted as a test for the emerging hypothesis.

Chapter six:

Chapter six reports the preliminary findings of this research in relation to the situation and context pertaining at the time of its commencement. It reports on some of the views expressed in questionnaires 2 and 3, but primarily centres on those recorded in questionnaire 1. It examines the attitude and expectations of the teachers towards the strategy, and outlines how they feel its adoption will affect their practice. Through an examination of these views, general patterns were identified in the responses of the teachers. More individualistic attitudes and expectations were also highlighted. This helped determine topics and themes for follow up at a later point in this research. Structured in two sections, the first section describes the expectations of the teachers towards the strategy. It shows how they welcomed its introduction - despite the many curricular changes in recent years (see Ch. 2 below), despite the increased constriction it brought to teaching (see Ch. 3 below), and bearing

in mind an already heavy workload (National Association of Head Teachers 1999). None of the teachers felt the strategy was not necessary. Regardless of the increased constriction and the adoption of a particular philosophy of mathematic education, however, most reported that it would only change how they teach 'a little' rather than 'a lot'. The second section examines preparations for implementation and what this demonstrated about the teachers' attitude and beliefs towards the strategy. It also looked at the programme of training allocated by government alongside. It shows how the majority of the teachers did not expect their beliefs and values to change as a result of National Numeracy Strategy implementation. It also shows limitations identified by the teachers within the allocated three-day training programme, where most felt it had adequately prepared them for strategy implementation in 'some areas' rather than in 'all areas'.

Chapter seven:

Chapter seven reports the findings in relation to how the teachers perceive confidence. The main source of data for this chapter is the open-ended items of questionnaire 2 providing mainly qualitative data, although it does also draw on data from the other two questionnaires in support. An examination of the responses of the teachers identifies how they conceptualise confidence. The range of their response gives a fuller picture, allowing general patterns and more individualistic attitudes to be identified. Structured in six sections, the first section describes how the teachers believe confidence affects their practice, with most reporting that it affects both teaching competence and pupil confidence. Sections two and three define what the teachers understand confidence and a lack of confidence, to be. Arising from their responses, secure connected subject knowledge and sound teaching are identified as

the two main areas upon which these teachers believe confidence is centred, with a positive attitude visible alongside. They attribute a lack of confidence to insecure or inadequate subject knowledge (discussed in section four) and to their own experiences as a pupil (discussed in section five). Finally, section six reports the close link reported by the teachers as existing between confident and competent teaching.

Chapter eight:

Chapter eight reports on the impact of the National Numeracy Strategy on confidence, given that the strategy encompassed two means through which confidence could be built-up – by way of a course of training and through implementation of the strategy itself. The main source of data for this chapter is questionnaire 2 and questionnaire 3. One further source is a longitudinal study of two teachers who responded to questionnaires 1 and 2. Validation is provided through the focus group discussions. Structured in six sections, the first section reports on how the teachers perceive confidence generally speaking, post National Numeracy Strategy training and implementation. The second section describes how the same teachers describe their own levels of confidence. Responses reveal that they rate the increase of personal levels substantially lower than the level they perceive generally. Section three inquires into how the teachers feel the strategy has impacted on confident practice. The teachers believe that confidence has increased but that it is still lacking. They report greater benefit from strategy implementation than from strategy training - arising from limitations within the allocated training, and benefits arising from implementation. The fourth section examines an area of disagreement - detailed planning. Whilst some find the drawing up of detailed plans

useful, others feel it is excessive, a waste of time, adding to their already heavy workload. The fifth section reports a longitudinal study of two teachers, examining their development with regard to confidence through their responses to questionnaire 1 and questionnaire 2. Finally section six looks to validate the findings through the two focus group discussions and questionnaire 3.

Chapter nine:

Chapter nine outlines the conclusions and recommendations arising from this research. As the final chapter in this work, it draws together the findings and reports the conclusions, addressing the main research questions in turn.

Chapter 2: The historical context of mathematics in the primary school and teacher confidence.

This chapter traces the historical background to the National Numeracy Strategy, the context from which the strategy and the Task Force focus emerge. It is structured in two sections. Section one briefly outlines changes since the 1950's, including the introduction of the modern mathematics system in the 1960's and the implementation of a statutory curriculum in 1989, Mathematics in the National Curriculum. Section two looks at teachers and the effect of each change on practice in the classroom.

The Task Force notes "recommendations for a National Numeracy Strategy that we believe will improve standards and raise expectations in primary mathematics." (Numeracy Task Force 1998a, p.2) This new strategy and its accompanying focus, however, follow on from a history of other initiatives. Outlining the background to the strategy is important because it allows us to trace from whence the strategy and this focus emerged. It highlights the degree of change required of teachers, with regard to what and how they are teaching, at a time when their confidence is supposed to be increasing. It also determines the educational context from which the teachers in this research themselves emerged. This could prove significant were they to identify their own mathematics education as a significant factor affecting their confidence, how they teach and how they perceive their teaching. Outlining briefly the background to the strategy can also give a warning of some of the things ahead, with regard to curricular change, the implementation of new initiatives in the classroom, and the preparation of teachers for adopting change into practice.

2.1 Mathematics education.

What mathematics as a subject is understood to be is likely to change with time, given that growth and development in any education system is usually ongoing, in curricular and pedagogical, as well as philosophical terms. This change could arise, for example, from the changing needs of society, different expectations concerning what mathematics should be taught, beliefs about how it should be taught or how it is learned (Marino 1998). The 1960's heralded a period of great change, with new ideas spreading "so as to affect at least a majority of primary schools, and to justify the name of revolution in a substantial minority" (Plowden Report 1967, p.135). Leading up to this change, the Mathematical Association Report (1955), "The Teaching of Mathematics in the Primary School", described teaching as based mainly on rote learning. It argued that practice should focus on gaining real understanding and a mathematical way of thinking. Pupils should develop through "their active response to the experiences which come to them; through constructive play, experiment, and discussion" (p.5). It concluded that mathematics should be activity based, concerned with aspects and ideas relevant to the pupil, where pupils develop at their own rate and level. To that end it recommended that the curriculum incorporate three main aspects in its teaching - mathematical thinking, practical activity and rote learning – leading to greater pupil enjoyment and maximising learning.

Much of this was not new (Hadow 1931, Curtis 1948), attempts had been made "to make arithmetic more practical and more interesting but it was not until a mathematical, rather than a purely arithmetical, approach began to be made, that the whole subject began to take on a new look" (Plowden Report 1967, p. 235). A series of mathematics conferences timed to correspond with similar conferences in America and mainland Europe, were held at Oxford (1957), Liverpool (1959) and Southampton (1961). Although as Curtis (1948) points out the ideas of 'modern mathematics' had

been circulating for a number of years, it is from these conferences that its emergence is usually associated. The purpose of the conferences was to discuss the teaching and learning of mathematics. Arising from the discussion, several projects were set up – such as the School Mathematics Project (SMP), which emerged directly from the Southampton conference; the Nuffield Project; the Midlands Mathematics Experiment and the Scottish Mathematics Group. Some were to last up to the arrival of a statutory curriculum, Mathematics in the National Curriculum, in 1989.

The modern mathematics system focused on helping pupils understand what they were doing in mathematics and why, "Attention is now being focused on ways in which children can discover mathematical ideas for themselves, instead of being taught mechanical procedures, which they often master without a glimmer of understanding" (Biggs in Land ed 1963, p.71). Teachers were encouraged to develop activities suited to the abilities of all pupils, with practical activities, investigation work and language all highlighted (Biggs in Land ed 1963, Schools Council 1965, Dearden 1968). As the Plowden Report (1967) pointed out, however, this approach demanded "a considerably greater knowledge of mathematics or rather degree of mathematical understanding in the teachers than the traditional one. If the children have to think harder, so do the teachers" (p.238). Biggs emphasised the importance of teachers experiencing the mathematics for themselves, they need to be "convinced that it is the right approach" (in Land ed 1963, p.73) and as Brown (in Thompson ed 1999) points out, the Nuffield policy "I do and I understand", applied to teachers as well as to pupils.

In terms of teaching, subject based work was generally replaced by project work. This formed the basis of the integrated day, which developed from open-ended approaches to learning, involving greater organisational flexibility and more pupil choice with regard to their learning. Marsh (1970) described it as an "untimetabled"

day, Brown and Precious (1968) see it as a day combined into a whole with the minimum of timetabling. Dearden (in Walton ed 1971) believes it was an organisational concept, rather than to do with curriculum, aims or teaching methods. Clearly, however, more mathematics was to be found in some topics than in others. Walton (1971) noted particular concerns raised by teachers and educationalists at a conference at Exeter University. He quotes two attendees, "Mathematics should be structured, as this is the one subject that has to be taught by direct teaching" (p.11) and "Mathematics could only rarely be properly integrated and contrived situations (for integration) were hardly likely to lead to a logical development of understanding of this subject by the child" (p.11) Whilst some teachers may have allowed for the teaching of mathematics skills outside the topic area, others may not. Possible dangers therefore included obtaining a balance within the mathematics curriculum, the teaching of basic mathematical skills, and the need to monitor the learning and progression of each pupil closely. Dearden (in Walton ed 1971) notes a further danger, that a subject be excluded not on its own merits or demerits "but on the grounds that it is against the spirit of the integrated day, or is out of line with the more individualized modes of learning presupposed by an integrated day" (p.55).

The Parliamentary Report of 1977 expressed concern, noting an apparent lack of basic computation skills, an increase in mathematical demands, a lack of qualified mathematics teachers and a multiplicity of syllabuses. The reported decline in basic computation skills could have been affected by the increasing curriculum, by a change in emphasis with regard to how mathematics is taught, and by emerging ideas concerning how it is learned. Also as Brown (in Anguileri ed. 2001) points out, a broadening of the mathematics curriculum to include areas such as sets and statistics meant that arithmetic was now one part of a much broader mathematics curriculum in

primary schools. The report noted "the responsibility of teachers of mathematics and other subjects to equip children with the skills of numeracy" (quoted in the Cockcroft Report 1982, p.ix). In response, the government commissioned an inquiry under Sir William Cockcroft into the teaching of mathematics in primary and secondary schools in England and Wales.

The Cockcroft Report (1982) acknowledged the importance of mathematics and its difficulty. It called for a standard unified curriculum, not too extensive but one appropriate to lower achieving students, which should allow work to be covered in a variety of ways and incorporate the complete mathematical experience. This it argued should help develop understanding, aid mastery and increase confidence. It outlined certain elements as necessary for effective mathematics teaching –

- teacher exposition;
- discussion between the teacher/pupil and pupil/pupil;
- practical work;
- consolidation and practice of fundamental skills;
- problem solving;
- investigation work.

There is much similarity between these elements and those in Mathematics in the National Curriculum (DES 1989), which outlined recommendations for teaching that included -

- teacher exposition
- teacher/pupil and pupil/pupil communication
- practical work
- the practice of skills for reinforcement

- problem solving
- investigations.

Both place an emphasis on skills, investigations, problem solving and practical activity. Both emphasise the role of the teacher in teaching; the importance of pupils learning, thinking and doing; and the need for mathematical communication between pupil and teacher and between pupil and pupil. Ernest (1994a) suggests a further similarity, between the bottom-up approach advocated in Cockcroft and the ascending levels found in the national curriculum. Interestingly in light of National Numeracy Strategy requirements, as Brown (in Thompson ed 1999) points out, the report also refers to the need for mental mathematics, problem solving and whole class teaching (see Ch. 3 below). The influence of Cockcroft would appear to be far reaching in the philosophy of mathematics education it promotes - the Framework for Teaching Mathematics (DfEE 1999) notes, "High-quality direct teaching is oral, interactive and lively. It is not achieved by adopting a simplistic formula of 'drill and practice' and lecturing the class, or by expecting pupils to teach themselves from books. It is a two-way process in which pupils are expected to play an active part by answering questions, contributing points to discussions, and explaining and demonstrating their methods to the class" (p.11) (see 3.2 below).

As a centrally controlled document, Mathematics in the National Curriculum (DES 1989) provided a uniform curriculum throughout England and Wales. Prior to 1989 each school was free to choose from a variety of options - such as Local Education Authority guidelines, commercially produced textbooks, a scheme drawn up by the head teacher or subject coordinator, a scheme taken un-adapted from another school, a scheme adapted from another school, or even where each teacher was left to follow her own ideas. For some pupils, therefore, progression could have been a very real problem

where, without close monitoring, pupils were in danger of missing certain mathematics topics altogether whilst covering others to excess. This was a particular problem for pupils who changed schools, especially those whose parents moved from area to area in line with their job or a particular culture. Mathematics in the National Curriculum was not, as the Non-Statutory Guidance (DES 1989a) notes, designed as a teaching manual or syllabus of work. It provided uniformity whilst allowing the teacher freedom to decide how it should be taught and where the emphasis should lie. Teachers could therefore retain their own philosophy of mathematics education, hold to their own beliefs and values concerning mathematics teaching and learning, whilst still addressing all statutory requirements.

In drawing up a curriculum there are a number of factors to be considered:

- the objectives to be attained, what is the purpose of the curriculum and what are the desired outcomes;
- the best experiences whereby to achieve those objectives, making sure that they are manageable and achievable, if not clearly defined then deciding on the best and most appropriate experiences is more difficult;
- an evaluation of what has been learned, both in terms of the objectives, the desired outcomes and the experiences provided.

Kerr (in Hooper ed 1971) notes the need for four elements in drawing up a curriculum - a set of objectives; an evaluation of what has been achieved; and the necessary experiences to achieve those objectives, which he divides into two separate groups to include content and experiences. In so doing he is distinguishing between the planned curriculum (the content which the government lays down based upon its objectives) and the taught curriculum (the experiences which the teacher provides in the classroom

to achieve those planned objectives). Clearly two teachers could take the same content and present it in very different ways, resulting in differences in the learned curriculum. In addition, it is possible that a hidden curriculum could impact on that learned curriculum, arising perhaps from the teacher addressing the Standardised Tests (SATS), from the school's particular way of doing things, from gender issues, or from physical constraints such as a large class in a small classroom (Marino 1998).

Mathematics in the National Curriculum (DES 1989) set down in fifteen attainment targets a statutory curriculum for mathematics, where pupils progressed through a series of levels, set out in the programmes of study for each attainment target. Achievement was levelled against the expected average and Standardised Tests (SATS) were administered nationally at the end of each key stage. Whilst the 1989 orders were replaced in 1991, and again in 1995, the philosophy, aims and underlying purpose of the original remained unchanged throughout (DES 1989a). The overwhelming complaint at each revision, however, concerned the quantity statutorily required to be taught, exposing the possibility of quality being sacrificed for quantity (Dowling & Noss 1990, Askew & Wiliam 1995, Webb 1993 & 1994, Dearing 1994). In recognition of this, the 1991 orders (DES 1991) showed a reduction in attainment targets from fifteen to five. Reports, however, still highlighted insufficient time in which to address the entire document (Webb 1993). It was argued that even were it possible on paper to cover all aspects, there was insufficient time in the school day to teach all that was statutorily required (Webb 1993). It is interesting therefore that the Cockcroft Report (1982) eleven years earlier had noted, "when designing a curriculum which is suitable for lower-attaining pupils, the syllabus should not be too large so that there is time to cover the topics which it contains in a variety of ways and in a range of applications" (p.134). The 1995 orders (DES 1995) showed a further reduction to four

attainment targets. Whilst appearing a great decrease, in reality much of the original - such as measures - was removed as an attainment target in its own right only to be relocated under another attainment target. Each attainment target therefore became larger with more strands, which made planning and assessment more complicated.

It was argued that Mathematics in the National Curriculum (DES 1989) was a hierarchical document, constraining pupils in the limitations of the confines laid down in the document (Dowling & Noss 1990). It forced all regardless of ability, attainment or vocational intentions, "to study equally all the designated branches of mathematics" (Gatsby Charitable Foundation 1995, p.3) but failed to provide sufficient emphasis on arithmetic at primary or secondary levels, where "breadth of curriculum continues to be given priority at the cost of their mastery of basics."(p.3) It was argued that the mathematics curriculum in England was "more concerned with teaching a wider range of knowledge at an early stage than the curricula of other countries, which seek to secure fluency in number before introducing other topics." (Numeracy Task Force 1998a, p.15) This was not new. As already noted in 1977 the Parliamentary Report had noted an apparent "lack of basic computation skills" (quoted in Cockcroft 1982, p.ix). Ten years on the HMI (1989) report, the 'Teaching and Learning of Mathematics, Aspects of Primary Education', found overall performance to be mainly poor in approximately 25% of the schools inspected. Downward trends were particularly noted in important aspects of numeracy (Alexander, Rose & Woodhead 1992, paras 24-50). The Chief Inspector of Schools Annual Report (1993) highlighted unsatisfactory achievement generally in mathematics but with more incompetence in numeracy. The Review of Inspection Findings for 1993-94 (OFSTED 1995) expressed concern at mathematical achievement in 33% of the primary schools inspected, whilst the London Mathematical Society, the Institute of Mathematics and the Royal Statistical Society

(1995) joint report "Tackling the Mathematics Problem" acknowledged pupils who were less able to analyse multi-part problems and who lacked technical facility in numerical work. OFSTED (1997) highlighted long-standing weaknesses in the mathematical performance of nine and thirteen year old pupils, especially in number. A discussion paper on the teaching and assessment of number KS1-KS3 (SCAA 1997) pointed to comparatively poor performance over a period of time, citing evidence from Bierhoff (1996), Lapointe, Mead and Phillips (1992) and Robitaille and Garden (1989) in support.

There are certain factors that should not, however, be forgotten. There is the difficulty of comparing standards today with those of twenty years ago given great changes to curricular content during that time. There are the changing needs of society that look to different desired outcomes and hold different expectations of what a mathematics education should contain, what it should address, and how it should be taught (Marino 1998). Also, the validity of large-scale international studies such as SIMSS (Cresswell & Grubb 1987) and TIMSS (Harmon, Smith, Martin, Kelly, Mullis, Gonzalez & Orpwood 1997) could be questioned given the difficulty of ensuring a fair comparison given different curricula, education systems and cultures (Brown 1998). There is also the fact that the mathematics curriculum has increased steadily over the years with new aspects introduced, such as technological areas, but little removed and with no corresponding increase in the school day, leaving less time for each topic. Wiseman and Pigeon (1972) note the difficulty in removing topics from an existing syllabus, "Any proposal to omit something which has previously been taught always arouses opposition" (p.11). Concerns over number could also be affected by a change in emphasis in how students are encouraged to approach their mathematics. For

example, to use trial-and-error investigative methods in solving problems, thereby avoiding some of the more analytic abstract areas.

Notwithstanding, the need to raise standards in number was highlighted in several reports (London Mathematical Society et al 1995, Askew & Wiliam 1995, Sutherland & Pozzi 1995, Gatsby Charitable Foundation 1995, OFSTED 1997). This is particularly interesting for several reasons. First, given the emphasis and weighting already placed on "number" in the national curriculum and the Standardised Tests (SATS), where more than three-quarters of the marks at KS1 and approximately two-thirds at KS2 cover number (Numeracy Task Force 1998a). Second given the back-to-basics policy promoted by the government since 1989 - although clearly what constitutes 'basics' is open to interpretation. The Cockcroft Report (1982) defines basics as referring to the four operations – addition, subtraction, multiplication and division – but treated in isolation, not applied to problem solving, investigations or everyday situations. On such an understanding Whitfield (in Preston ed 1987) believes the results of a back-to-basics approach would today be "most unlikely to be those which its proponents wish to see" (p.156). Nonetheless, the desire to equip pupils with a good level of numeracy (see 3.1 below) and proficiency in the four operations need not imply a return to the teaching approaches of the early 1900's. As Cockcroft (1982) acknowledged, "An excessive concentration on the purely mechanical skills of arithmetic for their own sake will not assist the development of understanding in these other areas" (p.80). It is within this context that another new initiative for the teaching of mathematics, the National Numeracy Strategy, was introduced (see Ch. 3 below).

The Revised National Curriculum (DfEE/QCA 1999) was drawn up alongside the National Numeracy Strategy (see Ch. 3 below). Although implemented one-year after the strategy, "Those schools that fully implement the

Framework will fulfil their statutory duty in relation to the National Curriculum for mathematics at key stages 1 and 2" (DfEE/QCA 1999, p.6). It set out twelve proposed revisions. These included: re-aligning the programmes of study; integrating "using and applying mathematics" into the other attainment targets, but also retaining it as an attainment target in its own right; changing the level descriptors in line with content changes; increasing the emphasis on mental calculation strategies; giving greater specificity to algebra at year 7; recasting AT5 (Handling Data) for year 7; and increasing the emphasis on number. Some adjustments were also made to end of key stage Standardised Tests (SATS) to bring them in line with new statutory requirements.

2.2 Teacher confidence.

The Mathematical Association Report of 1955 observed a great many teachers adhering closely to the textbook, written question and answer techniques, and rote learning. As Dearden (1963) points out, the general pattern had been to deliver the arithmetic lesson followed by "drills, practices, catechisms, tests and revisions, with uniform standards of attainment for all, and success achieved if evidence of adequate memorization could be shown" (p.3). Recommendations in several reports over the years for a change of practice, incorporating a more practical approach aimed at developing pupil understanding, appear to have been ignored (see 2.1 above).

So why were teachers apparently reluctant to forego close adherence to the textbook? It may have resulted from general school policy, where the textbook was laid down by the head teacher as a scheme of work and also as a means of addressing the Revised Code of 1862, the national standards and later the 11+ examination. It could have arisen as a result of external constraints such as a large

class, possibly in a small classroom and with few resources. The need for a cheap form of schooling meant class sizes of "fifty or sixty or even many more was very common" (Dearden 1968, p.3). There is a further possibility, the fact that as Blyth notes, "most of its teachers were themselves too limited in ability and in education" (quoted in Dearden 1968, p.5).). There are certain advantages in adhering closely to the textbook. It provides a progressive scheme of work for the year, outlining content for each lesson as well as exercises for the pupils. It removes the decision of what to cover, when and how. It could therefore present an easy route to greater confidence. Furthermore, the fact that a large number of the teachers at the time adopted the same approach to their teaching is likely to have given support through uniformity. It is interesting therefore that the first year report on the National Numeracy Strategy (OFSTED 2000a) undertaken twenty years later, refers to teachers who teach mainly through the textbook, noting the danger of over-using published schemes "which can reduce impact" (p.9). More knowledgeable teachers use published materials but selectively (OFSTED 2000a). This is supported by the HMI Report on the Teaching of Calculation in Primary Schools (HMI 2002) "Teachers rely too much on worksheets and commercial schemes" (p.3). The danger in so doing is that they limit the opportunity of pupils "to develop and use their own methods of recording" (p.3).

Bromme and Brophy (in Christiansen, Howson & Otte ed 1986) attribute close adherence to the textbook to a lack of teacher subject knowledge, teachers whose subject knowledge is insecure and unconnected "are likely to rely too heavily on the textbook, to present the content in a fragmented way without sufficient explanation of key concepts or problem solving strategies, and to be ineffective at individualizing instruction, diagnosing error patterns, or responding to unanticipated

difficulties or opportunities that arise during instruction" (p.123) (see 4.3 below). According to Harries and Barrington (2001), using the published scheme as a curriculum or syllabus of work results in teachers becoming managers of the scheme rather than teachers. In so doing, they require less emphasis on their own knowledge of the subject (see 4.3 & 4.5 below). Following a textbook, however, need not necessarily reflect insecurity. Might not the teacher hold to a certain style of teaching, have a particular philosophy of mathematics education, or be addressing school policy? The question concerns not whether the textbook is being used, but how and why it is being used, whether in support of teaching or as a lifeline. Is it the sole mathematical resource to which the pupils are exposed? Is it followed page-by-page on a daily basis? Is it fragmenting the mathematics? Or is it simply one resource within many, used appropriately and to great effect? This distinction is confirmed in the King's College Report on Effective Teachers of Numeracy (Askew, Brown, Rhodes, Wiliam & Johnson 1997). The report found the same published mathematics schemes used by highly effective teachers as well as comparatively much less effective teachers.

Whilst close adherence to the textbook may have helped to increase teacher security, it will not necessarily have increased competence. Indeed, it could well result in the opposite. Simmons (1993), looking at effective approaches to the teaching of mathematics, noted the possibility and danger of allowing the scheme to dominate how a particular topic is presented and developed. Simmons suggests that the published scheme "inhibits any arrangement which encourages pupils to test their ideas against others or to reflect on their experiences" (p.39). Most published schemes are linked to the current curriculum and as such cover all that is statutorily required. Where the emphasis is actually placed within that scheme or textbook -

with regard to the topic, approach, resources and pupil exercises – could, however, vary greatly affecting what and how a topic is presented and therefore what the pupil learns. It is also likely therefore to affect how the pupil uses his mathematics and possibly even whether he acquires a mathematical way of looking at things, given that it can limit the mathematical opportunities for learning. If the teacher sees her job solely as the presenter of material covered page by page, then as Simmons (1993) notes, there is "the tendency not to do mathematics for one's own sake, and not to read a number of varied accounts and presentations, and not to discuss with colleagues in order to develop one's own ideas about a topic" (p.39). Simmons sees this as a particular danger for young and inexperienced teachers. Surely it could, however, equally apply to any teacher lacking secure subject knowledge (see 4.3 below)?

The Preliminary Report (Numeracy Task Force 1998a) argues that where freedom is left to the teacher some use that freedom constructively, but others turn "sometimes uncritically, to published schemes to fill this gap, because of their own uncertainties about the subject and how best to teach it to children." (p.16) Yet the popularity of the Framework for Teaching Mathematics (DfEE 1999), demonstrated by almost all of the teachers in this research and discussed later in this work (see Ch. 6 & 7 below), suggests that "many teachers would prefer to have greater guidance about what they should be doing in the classroom." (p.16) Why, given that one might expect teachers to resent rather than welcome greater prescription (see Ch. 3 below)? Although a core subject, mathematics is one subject within the primary curriculum. As generalist practitioners, primary teachers are expected to address upward of ten during their training and their teaching. The time available for each subject during training must therefore be limited. As OFSTED (1997a) points out, "It is

surely unreasonable to expect the primary teacher, particularly towards the end of Key Stage 2, to be equally strong in all 11 subjects, and yet as a nation we are demanding higher achievement of our children and have higher expectations of our teachers." (p.8) The implication for a trainee teacher who is not strong mathematically is clear to see (see 4.2 below). A case could perhaps be made for specialist teaching in certain subjects - either because of the level of difficulty and importance, such as mathematics; because of the benefit which specialist knowledge can provide in that particular subject area, such as music; or because of the particular subject strengths of staff within a particular school (Marino 1997). Indeed, some primary schools do adopt specialist teaching at KS2 for one or two subjects. There can be benefits in this approach, as the OFSTED (1997a) survey on the use of subject specialists to promote high standards at KS2 noted, "teachers reported that they felt secure, teaching from their strengths and also not having to teach subjects in which they lacked confidence" (p.18) (see Ch. 4 below). Generally, however, specialist teaching is not the norm at primary school, where traditionally each teacher is expected to teach all subjects to her own class.

The medley of curricula and guidelines during the 1970's and 1980's meant that for some, the introduction of the national curriculum presented a welcome clarification of what was required to be taught and when (Koshy 1997). By laying down content the government removed the question of what to teach, and the teacher was at least assured that what she was teaching was 'correct', although it took time to become familiar with upward of ten curriculum documents. The national curriculum also provided progression and continuity from year to year and appeared to offer curricular stability, allowing teachers the opportunity to develop and improve each year. New orders in 1991 and again in 1995, however, meant that guidelines, policy documents, records of achievement and assessment documents all had to be re-written.

The King's College Report on Effective Teachers of Numeracy (Askew et al 1997) cites evidence by Bierhoff and Prais (1995) comparing the hours of teachers in different countries, teachers in England were found to have longer working hours and less free time than in other European countries. Campbell and Neill (1991) found secondary school teachers spending almost as much time on administration as on teaching, and given that secondary school teachers generally only teach one or two subjects, the situation for the average primary teacher is unlikely to have been better. This is confirmed in two other studies inquiring into KS1 teacher workloads (Campbell, & Neill 1990; Campbell, Evans, Neill & Packwood 1991). Interestingly, frequent changes to the curriculum during the 1990's and the need for more time and greater curricular stability, are raised by the teachers in their response to the open-ended items of this research as factors which they believe affect the building up of confidence (see Ch. 8 below).

2.3 Summary.

This chapter traced the background to the National Numeracy Strategy, the context from which the strategy and the Numeracy Task Force (1998) focus emerged. Structured in two sections, the first section outlined changes since the 1950's - the introduction of the modern mathematics system in the 1960's and the statutory national curriculum of the 1990's. It also looked briefly at the Revised National Curriculum (DfEE/QCA 1999), drawn up alongside the National Numeracy Strategy (see Ch. 3 below), based upon the same beliefs and values, and therefore encompassing the same structure, approach and philosophy. Section two examined the effect on teachers and their classroom practice – given that different approaches

were required by each initiative, based upon the philosophy promoted therein. Arising from this discussion the following conclusions were reached:

- Our understanding of what constitutes a mathematics education has changed during the course of the twentieth century. The requirements, needs and expectations concerning the mathematics curriculum, what it comprises and what it should comprise, have also changed. What we teach and how we teach, are likely also therefore to change. Regular changes in policy and to the curriculum should therefore be expected as they reflect changing needs, expectations and knowledge – as determined by the government and society generally.
- Each initiative arises from its own particular philosophy of mathematics education - shaping the content, teaching and learning; outlining how mathematics should be taught; and arising from how it will be learned. But what of the teacher who holds to a different philosophy? Do the beliefs of the teacher hold any importance for teacher confidence and competence, for pupil learning, for how the teacher perceives herself, how easily or how successfully she adopts new ideas into practice (see 4.6 & 4.7 below)?
- A question arising from the introduction of past initiatives is the degree to which confidence is necessary for the successful adoption of new ideas into practice. Given that there would appear to be a history of good advice not being implemented into practice, then why not? How can teachers be persuaded to adopt change into practice? Is it a question of ability, knowledge, confidence, beliefs, skill or a combination? What steps should be undertaken to prepare

teachers for the confident and competent adoption of major change into practice (see 3.3 & 4.6 below)?

- A further question arising from this discussion concerns the effect of a new initiative on teacher confidence, given an increased workload, greater pressure and a general lack of time. Can existing confidence levels be maintained, never mind increased, at such a time (see Ch. 4 below)?

Chapter 3: The National Numeracy Strategy.

Chapter 3 examines the National Numeracy Strategy, what it is, what it promotes and what it expects in terms of confident and competent teaching. In so doing it provides an indication of the context in which teacher confidence is expected to increase, outlining the degree of change required of teachers in line with strategy implementation. This chapter is structured in three sections. The first section inquires into the question of numeracy and what it is - as distinct to arithmetic, which made up most of the mathematics curriculum during the first half of the twentieth century, and mathematics of which numeracy is a part. Section two outlines the Framework for Teaching Mathematics, examining content, approach, structure, focus, planning and philosophy. With a programme of training and support allocated by government, the means of preparing teachers for implementation and through which confidence is expected to grow, section three inquires into the role of in-service training. An examination of this training programme also provides an indication of the scale of the problem as perceived by government, given that the level of training is designed to address the problem perceived. This could prove significant were teacher responses to assess that provision as inadequate, highlighting a discrepancy between what they believe is actually needed and what is perceived by the Task Force and government as being needed.

3.1 What is numeracy?

Clearly the "pressures on teachers of mathematics from all quarters are enormous. Society is evidently relying on them to produce future generations who are as numerate as they are literate, and who are able to apply their mathematical knowledge in new

technological contexts as well as on the workshop floor and in the marketplace." (Shuard & Quadling 1980, p.1) According to Shuard and Quadling the requirement for numeracy is relatively new with the word numeracy first used in the Crowther Report (1959) in order "to give a title to the scientific and mathematical studies which were to balance the curriculum of the arts sixth-former...Only in recent years has the word 'numeracy' changed its meaning to express the mathematical expectations which society has of all its young people." (pp.1-2) The Cockcroft Report (1982) for example equates numeracy with "an ability to cope confidently with the mathematical demands of adult life" (p.11). It defines numerate pupils as those who could "make use of mathematical skills which enables the individual to cope with the practical mathematical demands of his everyday life" (p.11). It further requires pupils to have "the ability to have some appreciation and understanding of information which is presented in mathematical terms" (p.11). It also, however, warns that "those who set out to make their pupils 'numerate' should pay attention to the wider aspects of numeracy and not be content merely to develop the skills of computation" (p.11). The Framework for Teaching Mathematics (DfEE 1999) defines numeracy in terms of confidence and competence, "Numeracy is a proficiency which involves confidence and competence with numbers and measures." (p.4) This use of "confidence and competence" with reference to numerate pupils is particularly interesting, given that the Task Force focuses "in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy." (Numeracy Task Force 1998, p.2)

The Secretary of State for Education adds to this definition, "Numeracy is a key life skill. Without basic numeracy skills, our children will be disadvantaged throughout life." (DfEE 1999, p.ii) Society certainly demands that we be numerate, able to

undertake those mathematical tasks required for daily life. To that end the strategy definition requires "an understanding of the number system, a repertoire of computational skills and an inclination and ability to solve number problems in a variety of contexts. Numeracy also demands practical understanding of the ways in which information is gathered by counting and measuring, and is presented in graphs, diagrams, charts and tables." (DfEE 1999, p.4) Whilst this covers certain elements of mathematics, however, it does not include all. Furthermore, as previously discussed number already carried importance - through the national curriculum where it was allocated an attainment target in its own right, and in the end of key stage Standardised Tests (SATS) where it has a 2:1 weighting (see Ch. 2 above).

The Framework for Teaching Mathematics (DfEE 1999) sets out certain requirements for numerate pupils. It believes they must:

- demonstrate a sense of the size of number and its place;
- be able to recall facts;
- use knowledge to reach an answer;
- display a range of mental and written strategies;
- solve problems;
- undertake multi-step operations;
- recognise an unreasonable answer;
- be able to explain methods and reasoning;
- estimate and predict sensibly;
- suggest methods;
- read tabular data;
- use a calculator sensibly.

This highlights the difference between mathematics and numeracy - numeracy comprises one part of the subject of mathematics and the primary mathematics curriculum, an important part certainly but not encompassing all of mathematics. It is interesting therefore that the teachers in this research make reference to this difference, with regard to a number of issues (see Ch. 6, 7 & 8 below).

3.2 The Framework for Teaching Mathematics.

All curricula are likely to be socially and culturally determined, given differences in terms of what is expected, how expectations are achieved and how achievement is measured (see Ch. 2 above). As already seen, Kerr (in Hooper ed. 1971) notes four elements necessary in drawing up a curriculum - the objectives, the content, the experiences, and the evaluation of learning. The National Numeracy Strategy, however, introduces a further element - how the curriculum is taught. To that end the Framework for Teaching Mathematics (DfEE 1999) provides a yearly teaching programme, rather than open levels to be considered throughout a key stage as in Mathematics in the National Curriculum (DES 1995). It addresses the quality of the teaching and learning through the structure, philosophy, approach and strategies - arising from the National Numeracy Project where a similar format was promoted (Straker in Thompson ed 1999). In outlining what and how mathematics should be taught, from reception to year 6, it notes certain key objectives "more critical than others if children are to become numerate" (DfEE 1999, p.3). It also lays down the intended range and balance of work for primary mathematics "to make sure that pupils become properly numerate." (p.2) Although non-statutory in itself, it was drawn up alongside the statutory Revised National Curriculum (DfEE/QCA 1999). It carries expectations for all schools.

The Framework (DfEE 1999) requires three connected levels of planning. Long-term plans cover what should be taught over the course of the year. Medium-term plans are undertaken each term, outlining the units of work, the main teaching objectives and when they will be taught. These provide the basis for weekly planning. Short-term plans are written up on a weekly or fortnightly basis. They note tasks, activities, questions, exercises, pupil groupings, classroom support, teacher support and teaching points. A number of sample lesson plans are also included to help teachers interpret the level of work with regard to planning, pace and assessment, thereby ensuring steady progression throughout the school. In addition, the Framework provides a set of planning grids outlining the topics in units of work and the recommended number of lessons/days for each unit and each year group, with days set aside for assessment. Whilst the Framework acknowledges that units can be taught in any order, such is the prescriptive level of the planning that across the country pupils of the same year group could find themselves addressing the same objectives during the course of any given week. Interestingly the field of planning was the one main area of dissent amongst the teachers responding to this research - some found the degree of detail required beneficial whilst others expressed quite the opposite view (see 8.4 below).

A key part of the strategy centres on the structure of the daily lesson. This incorporates three-parts. The first part involves whole-class work in order to "rehearse, sharpen and develop mental and oral skills" (DfEE 1999, p.13) given that, "An ability to calculate mentally lies at the heart of numeracy" (p.6). The Framework outlines a progression of mental work to allow pupils to sharpen and develop their skills. It includes, for example, counting in different sized steps, rapid recall of number facts in a variety of ways, working out new facts from known facts, explaining strategies and

building upon them. Chanting and counting around the class is a central part, with the use of certain resources actively promoted both on the three-day training course and in the demonstration videos - such as the empty number line, number cards and counting sticks. This has resulted in the widespread use of similar approaches, strategies and resources. It has also resulted in considerable change for many teachers. The second part contains the main teaching activity for the lesson, where the teacher outlines what the class will learn, what they should do, how long it should take and what they will need to bring to the plenary. The teacher draws links with previous lessons and maintains the pace. Work may be undertaken as a whole class, within groups, pairs or individuals. The third part outlines a whole-class plenary to "sort out misconceptions and identify process, to summarise key facts and ideas and what to remember, to make links to other work and discuss the next steps, and to set work to do at home" (DfEE 1999, p.13). The Framework (DfEE 1999) does emphasise that the typical lesson should not be "a mechanistic recipe to be followed" (p.15), advising teachers to use their professional judgement to determine the activities, timing and organisation of each part of the lesson to suit its objectives" (p.15). This, however, assumes that all will have the confidence to do so - somewhat surprising given that the Task Force outlines an urgent need to increase that confidence (see Ch. 6, 7 & 8 below).

One of the main areas in which the National Numeracy Strategy differs from Mathematics in the National Curriculum (DES 1995) is with regard to 'using and applying'. Within the national curriculum 'using and applying' was an attainment target in its own right, where it outlined the need for pupils to be given the opportunity to use and apply their mathematics in real-life problem situations. They were encouraged to reason, discuss, and reach a decision in the application of their knowledge. Whilst the strategy suggests there is more to mathematics than numeracy

and appears to incorporate 'using and applying' in the same capacity, as Hughes, Desforges and Mitchell with Carre (2000) point out, the stated intention is to retain the emphasis but the picture is not quite so straightforward when examined closely. For example, the key objectives for each year and the examples of pupil tasks are almost completely concerned with number knowledge and calculation. This suggests that the application of knowledge does not retain the same level of importance. As Hughes et al (2000) note, this is even the case with regard to the solving problems strand, where much of the 'using and applying' material has ended up. They argue that it is now hard to find traces of the process skills that underpinned 'using and applying' in the national curriculum, "Indeed, there is a marked contrast between these examples and the kind of open-ended problems advocated by the NCC materials described above (pp. 24-6). The examples provided in the Numeracy Framework seem to show a clear movement away from challenging applications work and towards the reinforcement and practice of calculation skills" (Hughes et al 2000, p.35).

The Framework (DfEE 1999) addresses most elements necessary for the daily lesson, including: the preferred timing and duration of the lesson; classroom organisation; example lessons; out-of-class work; homework; links with other subject areas; differentiating work within the class; grouping; catering for the very able and for special needs; organising and planning for mixed age classes; arranging the furniture; resources; short-term, medium-term and long-term assessment; short-term, medium-term and long-term planning; planning grids; and methodology. In so doing it constricts to a far greater degree the freedom of the teacher to interpret and teach in her own personal style – even given that she may already have experienced some constriction through the school mathematics policy, through the expectations of her head teacher and governors, or through the school's particular way-of-doing-things.

Teachers previously enjoyed the freedom to decide how each lesson should be approached and taught, it is therefore possible that this new degree of prescription could have been resented. Also, the promotion of one particular way of teaching calls into question the effectiveness of other approaches (see 6.1 below), which could have implications were teachers to feel that how they had previously been teaching was 'wrong'. It is not inconceivable therefore that some could resent the strategy. But could this resentment impact on the attitude of the teacher, on how she feels about the subject, on her confidence and her teaching, or on how she perceives that teaching (see Ch. 4 & 7 below)?

Bromme and Brophy (in Christiansen et al ed 1986) suggest that the behaviour and decision making of teachers with regard to teaching and learning is structured by their "attitudes, beliefs and expectations concerning mathematics as subject matter, themselves as mathematics instructors, and their pupils as learners" (p.122). Referring to attitude generally rather than confidence in particular, Bromme and Brophy argue that pupils develop their attitude, be it positive or negative, as a result of the teacher's attitude and approach, "pupils of teachers who view mathematics as interesting, enjoyable, and useful are likely to develop much more positive attitudes towards the subject than pupils of teachers who see mathematics as dull, difficult" (p.122). The Cockcroft Report (1982) sees pupil attitudes "derived from teachers' attitudes" (p.61) the teacher conveys "a message about mathematics which will influence his attitude" (p.101). Carter (in Cornelius ed 1982) is in agreement, citing the research of Aitken (1970) in support, whilst Askew & Wiliam (1995) and Bell, Costello and Kuchemann (1983) take this further, arguing that a well-motivated pupil holding a positive attitude is more likely to succeed when confronted by a problem. Those without "try to avoid challenges and show little persistence, because they believe that they are likely to fail"

(Askew & Wiliam 1995, p.28). Greater enjoyment and interest enables and encourages pupils to strive harder to fulfil the teacher's and their own expectations (Bromme & Brophy in Christiansen et al 1986), leading to greater achievement, which is self-perpetuating (Askew & Wiliam 1995). A negative attitude on the other hand not only inhibits learning but can also last well into adult life, possibly because "Once attitudes have been formed, they can be very persistent and difficult to change. Positive attitudes assist the learning of mathematics" (Cockcroft 1982, p.101).

Whilst referring to attitude generally, this does raise questions with regard to confidence and the implementation of a new strategy for the teaching and learning of mathematics (see Ch. 4 below). Can, for example, a teacher who lacks confidence demonstrate a positive attitude towards the subject, a new strategy and her teaching of that strategy? Can she be enthusiastic in portraying mathematics as interesting and enjoyable to pupils? Can she instil confidence in pupils and a sense of 'I can do this' (see Ch. 7 below)?

3.3 *The role of in-service training.*

Undertaking a new way of working demands much in terms of time, effort and support (see 4.6 below). It requires a positive outlook, not a tired acceptance of yet another change which is unlikely to last very long and where the temptation could be to continue teaching new material in the old way, riding out the changes. It also demands that teachers implement the strategy as designed and required to be implemented. Past experiences have shown that a well-planned curriculum only becomes truly effective when it is effectively taught (see Ch. 2 above). To that end the Numeracy Task Force (1998) "focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy. Our recommended

strategy provides training and support for all teachers, to bring about changes in the teaching of mathematics in primary, middle and special school classrooms, reflecting the good practice identified in our preliminary report" (p.2).

Three-day courses, undertaken by the Local Education Authority and usually lead by Numeracy Advisors and consultants, informed head teachers and subject coordinators on the new strategy, given that "both the Task Force and those responding to consultation recognise that it is the head teacher and mathematics co-ordinator who need specific training in order to lead the changes within a school" (Numeracy Task Force 1998 p.21). Schools receiving intensive support had an additional five-day training course, again LEA led, usually for the mathematics coordinator and one other teacher. For more than 97% of all primary teachers one term after implementation, however, the accompanying training consisted of limited observation of good practice through the demonstration videos, and a course of three in-service training days, undertaken in school during non-pupil days or after school in INSET time (OFSTED 2000). Interestingly, a significant number of the teachers responding to this research remarked on how beneficial they found the opportunity to observe good practice, both in the classroom and on the demonstration video where various examples of the different lesson parts were presented (see Ch. 6 below). This was useful in that it allowed teachers to see, and encouraged them subsequently to use, many of the new resources, methods, strategies and approaches.

Training followed a cascade format run by the school mathematics coordinator on the basis of attending the LEA three-day training course. Yet few coordinators received any training in how to train others (OFSTED 2000). More than one-year on the OISE/UT (Earl, Watson, Levin, Leithwood, Fullan, Torrance with Janzi, Mascall & Volante 2003) external evaluation of the strategies found that whilst almost all primary

schools had by 2002 received direct training in some aspects of the National Numeracy Strategy, "many teachers have not had any direct input from anyone outside the school" (p.41). Where the coordinator was good – and the teachers in this research reported than many were – this was not a problem. The implications for teachers where the coordinator was not, however, are not difficult to see (see 6.2 below).

Strategy training followed a particular laid down pattern. A standard package catered for all teachers regardless of existing knowledge, confidence, experience, class or current effectiveness. This package included lecture overheads, demonstration videos, handout sheets and group activities for each of the three days. As such, differences were only likely to occur where the confidence and experience of the numeracy consultant, advisor or subject coordinator impacted on the training, making it more or less effective as a result. The first INSET day aimed to unite all the teachers "behind the improvements in mathematics standards and changes in practice that the National Numeracy Strategy will entail" (Numeracy Task Force 1998, p.33) Undertaken towards the end of the summer term 1999, it aimed "to equip all the other teachers to begin implementing the daily mathematics lesson at the start of the autumn term 1999" (p.33). To that end it provided an introduction to the strategy and the Framework, including: an overview of the strategy; an oversight of use of the Framework to plan the structure of the lesson; it addressed the characteristics of effective teaching; and the effective use of the three-part lesson. The second INSET day, undertaken towards the beginning of the autumn term 1999, addressed calculations. In so doing it covered: mental and written approaches to calculation; mental calculation methods; key resources and their use in the classroom; and interesting ways in which to teach multiplication tables and number facts. The third INSET day, undertaken in the spring term 2000, addressed: progression from mental to

written calculation methods, pupil errors, assessment and target setting (Numeracy Task Force 1998, pp. 33-34). As the Final Report notes, "This cumulative training should allow all classroom teachers to improve and refine their practice, so that by around the middle of the autumn term 1999, they are all implementing the daily mathematics lesson in detail. The training should equip them, as their knowledge and confidence increases, to provide the daily lesson with growing effectiveness throughout the school year 1999/2000" (Numeracy Task Force 1998, p.34). As such, strategy training aimed to prepare teachers to take on board the new style of teaching and address teacher confidence and competence as quickly as possible at the beginning of the strategy (Numeracy Task Force 1998).

The fact that each teacher approaches from a different starting point in terms of her own mathematical knowledge, experience and confidence, however, suggests that the same package is unlikely to suit all. Indeed, research has shown that training needs to allow for and address such differences (Fresko & Ben Chaim 1986, Irwin & Britt in Jaworski, Wood & Dawson ed 1999) (see 6.2 below). In addition, whilst regular long-term training undertaken over a period of time has been shown to be effective for improving practice - demonstrated through courses such as the 20-day GEST course (Grants for Education Support and Training) - this has not been shown for short-term training. The King's College Report on Effective Teachers of Numeracy (Askew et al 1997) notes that highly effective teachers of numeracy have generally undertaken courses of professional development, however, these were long-term rather than short-term courses. Webb (1993) also identified benefits gained from long-term courses, reporting that many teachers believed the 20-day GEST course made "a major contribution to their subject knowledge" (p.17). By comparison, short-term courses were mainly valued for opportunities "to make contacts and find out what was

happening in other schools" (p.17). According to Skemp (1976), in-service tends to fail as a long-term solution because teachers find it difficult to apply what they learn when they return to school. Back into the classroom situation he believes it is easier to revert to old more comfortable methods. Also, as the OISE/UT (Earl et al 2003) external evaluation of the strategies acknowledges, "Much research on professional development confirms, however, that actually changing behaviour or sustaining improvement requires more than information and guidance" (p.41). It points to a need for "sustained and job-embedded learning" (p.91), necessary "for large numbers of teachers to become competent and confident about new teaching approaches and content that may be fundamentally different from past practice" (p.91).

A danger in providing training that the teacher feels to be inadequate or which fails to meet the aim is that she is likely to view the whole experience as a waste of time. By comparison, a positive beneficial experience is likely to be recommended to others and repeated - an important aspect of training, given that as Sumner (1974) notes, improvement to practice can only be sustained by further regular attendance. It is interesting therefore that Batten (in Day, Calderhead & Denicolo ed, 1993) believes that the "deficit model of teacher development has been the basis of too many in-service education courses" (p.183). The cost of in-service in terms of time, effort and money means that there is no room for a 'deficit model', where the training is seen by those attending to be ineffective, irrelevant or unworkable. Teachers cannot afford to spend time on training they feel is inappropriate, out of date, impractical, which fails to cater for different levels of knowledge or address the reality of the situation they face in the classroom each day. It is interesting therefore that OFSTED (1997) found "one teacher in ten judged their training to be irrelevant or too idealistic" (p.47).

3.4 Summary.

In implementing the strategy the Numeracy Task Force (1998) "focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy" (p.2). Prior to an examination of confidence through the literature, this chapter outlined the National Numeracy Strategy, what it contains and what it expects - the context in which teacher confidence is expected to grow. Structured in three sections, section one inquired into numeracy and what it is understood to be. Section two outlined the Framework for Teaching Mathematics (DfEE 1999), what it contains, what it expects of teachers, the approach, structure, focus, planning and underlying philosophy. It also looked at the importance of the teachers' attitude to the strategy with regard to its confident and competent implementation. Section three considered the programme of allocated in-service training, the designated means through which the government intends preparing teachers for implementation and through which teacher confidence and competence is expected to grow. In so doing, the following conclusions were reached:

- Whilst numeracy is important, it is not synonymous with mathematics but comprises only one part of the subject, albeit an important part. The Task Force defines numeracy as "a proficiency which involves confidence and competence with numbers and measures." (DfEE 1999, p.4).
- A positive attitude is reflected in the teacher's teaching and is taken on board by pupils (Carter in Cornelius ed 1982, Cockcroft 1982, Bromme & Brophy in Christiansen et al ed 1986, Askew et al 1997). The pupils, through greater enjoyment and interest, strive harder to fulfil the teacher's expectations (Bromme & Brophy in Christiansen et al ed 1986). This positive attitude and feeling of success can lead to increased confidence and greater achievement,

which is self-perpetuating (Askew & Wiliam 1995). But can a teacher who lacks confidence demonstrate a positive attitude? Can she portray mathematics as interesting and enjoyable? Can she pass on a positive attitude to her pupils, a sense of 'I can do this' (see Ch. 4 below)?

- In promoting one particular philosophy and approach to mathematics teaching the strategy increases the degree of prescription and calls into question the effectiveness of other approaches. This could have implications for the teacher – in terms of how she perceives the strategy, the degree to which she welcomes it, the degree to which she believes it to be necessary, and the way in which she is required to teach given that how she previously taught could now be seen as 'wrong'. Certain resentment and therefore negative feeling is possible (see 6.1 below).
- The government allocated a standard three-day training package for teachers, given that "schools are more keenly aware of a need for direct support in numeracy than they are in literacy, because primary teachers tend to have less confidence about their teaching skills and subject knowledge in this area" (Numeracy Task Force 1998a, p.21). Designed to prepare teachers for strategy implementation and to increase confidence and competence in mathematics, "The training we envisage for all schools, and the distribution of the Framework for teaching and other materials, will begin to address this problem" (Numeracy Task Force 1998, p.20).
- Highly effective teachers of numeracy have generally undertaken extended courses of professional development (Askew et al 1997). Long-term courses are greatly valued by teachers (Webb 1993 & 1994). Yet, one term post

strategy implementation 97% of all primary teachers had received only the three-day standard training package, lead by the school mathematics coordinator. Few co-ordinators received training in how to train others (OFSTED 2000). Furthermore, whilst each teacher will have approached training from a different starting point, most received the same package regardless of existing knowledge, levels of confidence or experience. There are implications in terms of benefit and with regard to addressing the stated objectives behind the training.

- The Framework for Teaching Mathematics (DfEE 1999) emphasises that the typical lesson should not be "a mechanistic recipe to be followed" (p.15), advising teachers to use their "professional judgement to determine the activities, timing and organisation of each part of the lesson to suit its objectives" (p.15). This, however, assumes that all teachers will have the confidence to do so - somewhat surprising given that the Task Force outlines an urgent need to increase the confidence of the same teachers.

Chapter 4: Confidence in mathematics.

Chapter 2 outlined the curricular background and the historical context from which the National Numeracy Strategy and the Task Force focus - "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy" (Numeracy Task Force 1998) - emerged. Chapter 3 examined the strategy itself, with regard to approach, planning, structure and philosophy, outlining the context in which teacher confidence is expected to grow. Chapter 4 now explores the question of confidence through the literature. In so doing it seeks to establish what confidence is, how confident teaching is manifest and the importance of confidence to teaching and learning in mathematics.

Structured in seven sections, the first section of this chapter defines what confidence is, given that no definition is provided within the strategy or the associated paperwork. Section two looks at confident teaching and identifies the need for confidence with regard to mathematics subject knowledge as well as in its teaching. Sections three and four examine each of these in turn - confidence in mathematics subject knowledge and confidence in the teaching of mathematics, pedagogical knowledge and skills. Arising from this and given that the definition of confidence is a belief in ability, section five looks at confidence with regard to effective teaching, how confidence affects competence. The introduction of a new strategy within mathematics education highlights the need to adopt change into practice and the need for teachers to feel confident in so doing, not only in terms of what is required but also in how they are required to implement it. This is discussed in section six of this chapter, inquiring into what is required for new ideas to be taken on-board and successfully implemented into practice in the classroom. Finally, prior to an examination of the views of the teachers

on confidence, section seven looks at the question of teacher beliefs, given that confidence is a belief in ability and also the fact that this work inquires into what the teachers believe concerning confidence.

4.1 Confidence.

As with most initiatives, the National Numeracy Strategy arose from a desire by government to raise levels of pupil achievement in mathematics (see Ch. 2 above). The Preliminary Report of the Task Force notes, "we also want teachers and pupils to be confident and positive towards the subject" (Numeracy Task Force 1998a, p.9). To that end, "The main focus of the Task Force's work has therefore inevitably been at the level of teachers' individual effectiveness, as this will make the crucial difference to individual pupils' achievement in numeracy" (p.12). The Final Report identified what the Task Force believes the two key elements in achieving this to be, and also therefore the two key areas for development, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy." (Numeracy Task Force 1998, p.2) There are three issues inherent in this statement:

- the importance of confidence to effective practice and to increased levels of pupil achievement – where the Task Force notes a specific direction and purpose with regard to increasing teachers' individual effectiveness and levels of pupil achievement as a result;
- the need, rather than the wish or desire, to increase teacher confidence in primary mathematics;
- the urgency of doing so quickly.

Despite noting the importance, the need and the urgency, however, the Task Force fails to define what confidence is. It therefore leaves much to general interpretation, with teachers free to interpret confidence in light of their own beliefs, values, knowledge and experience. This is somewhat surprising given the importance placed upon it and suggests two possible reasons. First, there is an assumption that confidence and its importance to mathematics education is a generally understood and accepted factor, universally acknowledged by all and subject to one single definition. Second, there is an acceptance that all teachers are likely to hold a different view of confidence, to a smaller or larger degree, but that such differences are unimportant and likely to reflect only a small margin of difference.

The dictionary defines confidence as "trust, belief; self-reliance, boldness, assurance" (Baker 1956). Whilst this is a general definition without specific course to education or to mathematics, a picture can be drawn of teachers who are self-reliant, who demonstrate boldness and assurance in their teaching, and who trust and believe in their ability in mathematics and in its teaching. The Hay McBer Report (2000) also provides a definition for confidence, "The belief in one's ability to be effective and to take on challenges" (p.19). This definition is less general in that it specifically provides an educational interpretation. It is still not subject specific, however, emerging as it does from the report on Research into Teacher Effectiveness. Nonetheless, again it looks to beliefs, to effectiveness, to boldness and perseverance. A third understanding made within this research work and therefore specifically relevant to mathematics, its teaching and its teachers, originates from a teacher - "knowing the subject and being able to teach it and present it in an interesting and exciting way" (Questionnaire 2, question 6, see appendix iii) (see Ch. 7 below). Whilst each definition stems from a very different origin, with varying specifics in terms of education and mathematics

teaching, the similarity is quite clear. There is a general belief in ability, an assurance of knowledge and boldness in the face of adversity and challenge. The use of "belief" is particularly interesting, being within the general dictionary definition and the Hay McBer definition. The importance of what the teacher believes is significant to this work on two fronts (see 4.7 below). First because it is central to the main research question concerning what teachers believe and understand confidence to be. Second because it carries an importance in terms of confident and competent teaching, in terms of pupil attitude and achievement, and in terms of adopting change into practice (see 4.6 below).

Confidence therefore concerns beliefs, the belief which the teacher has with regard to mathematics, with regard to her security of knowledge in mathematics, and with regard to how she teaches the subject. It also concerns ability, where the teacher believes in her ability to teach effectively - from which will emerge a high level of pupil achievement. Interestingly, Brighouse (in Moon, with Isaac & Powney ed 1990) defines an effective school in terms of pupil confidence, "Ultimately the effective school is discerned in the confidence of its pupil" (p.142). Whilst not referring to mathematics in particular but to confidence generally, Brighouse points to confident pupils who are "not merely happy, they are unafraid, free, self-disciplined and autonomous" (p.142). Cigman (2000) also makes reference to fear in defining confidence. She notes that we talk about confidence and a lack of confidence in those areas "where doubt, fear, uncertainty are appropriate" (p.656). Given the Task Force focus, this is rather interesting, presenting an image of teachers of mathematics who are uncertain about the subject, uncertain of their knowledge therein, who doubt their ability with regard to its teaching and who fear it. Cigman believes that confidence and doubt are connected. Confidence she argues comes from doubting and overcoming that

doubt. That could, however, equally apply to fear, uncertainty and a belief in ability – where a lack of confidence stems from fear, doubt, uncertainty and a belief in a lack of ability. Confidence comes from overcoming them.

One further factor, not only does the Task Force fail to define what confidence is, it also fails to define in what exactly confidence is being built. Is it mathematical confidence – focusing on improving the teacher's own subject knowledge? Is it confidence in the teaching of mathematics, pedagogical knowledge and skills – where the teacher is confident as a mathematician but unsure in her teaching? Or is it confidence in the National Numeracy Strategy and how the government wish it to be implemented in the classroom – in terms of content, structure and philosophy? Could it be in all three? When the Preliminary Report notes, "Teachers who are confident about the mathematics they teach and are enthusiastic and effective, stimulate pupils' interest in the subject" (Numeracy Task Force 1998a, p.9), the reference is to confidence in mathematics and not just to one particular part of mathematics - numeracy (see 3.1 above). Furthermore, in seeking to raise levels of pupil achievement the Task Force recommends training "to ensure that the daily lesson will allow pupils to reach a high standard of numeracy. The training will cover mathematics subject knowledge relevant to the primary curriculum and pupils' later development, and effective teaching methods" (Numeracy Task Force 1998a, p.2). Again the reference is to training in mathematics subject knowledge, inclusive of numeracy but not exclusive to it.

4.2 Confident teaching.

Given therefore that confidence is "a belief in one's ability to be effective and to take on challenges" (Hay McBer 2000, p.19), what elements combine for confident teaching in mathematics? Is it the knowledge which the teacher has; the beliefs and values to

which she holds; how she teaches; her understanding of how pupils learn; how she stimulates pupils; her class and lesson management; her overall experience; or a gift without logic or reason that leads to confident teaching? OFSTED cites HMI reports which note "a strong association between standards and the subject knowledge, skills and understanding of the teacher." (OFSTED 2000, p.3) It also highlights weakness in the teaching of mathematics "frequently related to teachers' lack of confidence and subject expertise" (p.11). Good and Brophy (1977) point to the need to have a good grasp and confidence in teaching the subject. This is supported by the OISE/UT (Earl et al 2003) external evaluation of the strategies, which acknowledges that weaknesses in subject knowledge and pedagogical understanding limit the effectiveness of the teacher in teaching mathematics, with pupil achievement affected as a result.

Mathematical confidence centres on two areas:

i. confidence in mathematics – concerning subject knowledge: where the teacher is fully confident in her knowledge of the subject at all required levels, reception to year 6 (or year 7 in a middle/combined school), and where she has a firm grasp and understanding of the connections that exist within the subject;

ii. confidence in the teaching of mathematics – concerning pedagogical knowledge and skills: where the teacher is fully confident in her ability to teach to all required levels, reception to year 6 (or year 7).

In acknowledgement of this the Task Force recommends a programme of training to cover both - "mathematics subject knowledge relevant to the primary curriculum and pupils' later development, and effective teaching methods" (Numeracy Task Force 1998a, p.2). In identifying subject knowledge and teaching skills as the two key areas for building-up confident and competent mathematics teaching, the government are in

agreement with the vast majority of the teachers in this research who reported knowledge of the subject and how they teach it as the two key factors in confident teaching (see Ch. 7 & 8 below).

In the area of knowledge there are essentially three elements necessary for confident and competent teaching. These concern:

- subject knowledge – where the teacher is confident in her own knowledge of mathematics as a subject, in those aspects required within the mathematics curriculum and the school syllabus of work,
- teaching approaches – where the teacher is confident in her teaching of mathematics, in her organisation and management of the class and in the use of appropriate resources,
- how pupils learn – where the teacher is confident that she has a full understanding of how pupils learn mathematics, where they are in their learning and how best to move them forward, also what makes certain topics easy or difficult.

Grossman, Wilson and Shulman (1989) identify these as – content knowledge, conceptual knowledge and methodological knowledge. According to Harries and Barrington (2001) knowledge, plus an understanding of the context in which that knowledge lies, allows confidence and competence to grow. With the implementation of the National Numeracy Strategy and Revised National Curriculum (DfEE/QCA 1999), however, there is one further aspect that needs to be considered at this time and in these circumstances. The teacher will need to be confident in taking on-board and implementing a new initiative, incorporating new content and approaches in her teaching, following a particular structure to the lesson, and adopting a certain

philosophy promoted in the National Numeracy Strategy. As the OISE/UT report notes, "An important factor in the success of the implementation is the extent to which teachers and headteachers have the knowledge and the skills to make the change" (Earl et al 2003, p.90). Clearly the expectation and aim of the government is that teachers will not only maintain existing levels of confidence at this time, but also with the help of the allocated training package and the support of numeracy advisors, consultants and leading teachers, increase those levels as quickly as possible at the beginning of the strategy.

4.3 Confidence in mathematics - teacher subject knowledge.

With regard to subject knowledge, research has shown that there are four major outcomes for mathematics teaching and learning arising from the teacher having strong and secure connected subject knowledge. These include:

1. increased teacher competence (Choat 1980, Askew et al 1997, OFSTED 1995, OFSTED 2002);
2. greater pupil achievement (Bassham 1962, Shuard & Quadling 1980, OFSTED 1995, OFSTED 1997a);
3. increased teacher confidence (Fresko & Ben-Chaim 1986, Askew et al 1995, Barrington & Harries 1999);
4. greater ease in adopting change into practice (Irwin & Britt in Jaworski et al ed 1999, Manouchehri & Goodman 2000).

The link between subject knowledge and teacher competence is well documented (Choat 1980, Alexander et al 1992, Thompson 1984, Askew et al 1997, OFSTED 2000, OFSTED 2002). As Choat (1980) and Lampert (1986) point out, the teacher cannot pass on to pupils what she herself does not possess. The HMI (2002)

Report on the Teaching of Calculation in Primary Schools notes, for example, teachers' knowledge and understanding "have a strong influence on the quality of the teaching" (p.4). Secure connected subject knowledge has been shown to help teacher competence in a number of ways. It allows more effective questioning by the teacher - "Teachers with good subject knowledge usually have the confidence to probe and challenge through questioning, give better plenary sessions and match the tasks more closely to the needs of their pupils" (OFSTED 2000a, p.16). It allows the links that exist between various aspects of mathematics to be shown and used, linking previous activities and learning to current activities and learning – "Teachers with good subject knowledge . . . make links and connections with work in previous lessons" (OFSTED 2000a, p.16). It allows a broader view of mathematics and its application not only within the subject but also across other subjects - "Teachers with good subject knowledge . . . look forward with pupils to how they might use their skills to extend their mathematics" (OFSTED 2000a, p.16). Secure connected subject knowledge also helps shape the expectations of the teacher, with regard to teaching and learning, and influences how they use materials in the classroom (Manouchehri & Goodman 2000). It allows the teacher to utilise all mathematical opportunities when they arise (Choat 1980). Whilst mathematics is all around us, however, Choat believes that some teachers fail to recognise that fact due to a lack of subject knowledge, thereby diminishing their effectiveness, "Competent mathematics teaching is not possible unless teachers are aware of the mathematics which can be extracted from various learning situations" (p.52). It is interesting therefore that the OISE/UT (Earl et al 2003) external evaluation of the strategies notes "considerable disparity" (p.8) in teacher subject knowledge where "for many teachers, gaps or weaknesses in subject knowledge or pedagogical understanding limit the extent

to which they can make full use of the frameworks and resources of the strategies" (p.6).

The difficulty is that research has shown that teachers need to develop an understanding of the subject and of any new aspects introduced therein before they can successfully introduce pupils to those same aspects (Lampert 1986). The link between secure connected subject knowledge and pupil achievement is well documented. It highlights the importance of pupils being taught the connections that exist between the various aspects of mathematics (Askew & Wiliam 1995, OFSTED 1997, OFSTED 1997a, SCAA 1997, Askew et al 1997, Numeracy Task Force 1998). Secure connected subject knowledge allows the teacher to see and pass on to pupils the many ways in which a task can be undertaken, helping pupils to undertake tasks in a variety of different ways (Numeracy Task Force 1998a, DfEE 1999). It allows the connections that exist within mathematics to be demonstrated in different contexts and through different activities. Where the teacher knows and uses these connections, pupil achievement in those and other areas is greatly increased (Askew & Wiliam 1995). Teachers who themselves possess such connections are more effective and better able to develop such connections in their pupils (Askew et al 1997, Numeracy Task Force 1998). According to Bassham (1962) pupil efficiency in the learning of mathematics is directly related to, and dependent upon, the teacher's own grasp. The King's College Report (Askew et al 1997) on Effective Teachers of Numeracy agrees, "if a teacher's subject knowledge is limited or incorrect, what the pupils are likely to learn is going to be affected by this knowledge." (p.20) According to Stipek, Givven, Salmon & MacGyvers (2001) there are also implications for pupil attitudes, "teachers who lack self-confidence and do not enjoy mathematics have difficulty fostering these beliefs and attitudes in their students" (p.216).

The link between subject knowledge and teacher confidence has been demonstrated in a number of studies. Fresko and Ben-Chaim (1986) for example note from their research into confidence, competence and in-service training that the teachers who attended the in-service training course needed to boost not only their confidence but also their subject knowledge. They cite research by Friedlander (1985) and Fresko and Ben-Chaim (1984 & 1985) in support, highlighting the need for further research in order to explore "the nature and magnitude of the effect that teacher confidence has on teacher classroom behaviours and subsequent teaching effectiveness" (p.293). Barrington and Harries (1999) support this, having drawn similar conclusions from their own observations of fifty-eight Postgraduate Certificate in Education (PGCE) students. They took measurements at two points, at the start and at the end of the course. These were taken in the areas of number, algebra, shape and space, measurement, data handling, and ICT. From these measurements Barrington and Harries (1999) concluded that, "for most students there was a significant change in their confidence in these aspects of mathematics" (p.6). They reported that this change resulted from a specific focus on improving subject knowledge during the course of the year. Whilst noting the improvement at both KS1 and KS2, they acknowledged that the change for KS1 students was clearly more marked. Barrington and Harries made no suggestion as to why this should be so. It could, however, be attributed to a number of reasons. It may reflect the easier level of mathematics subject knowledge required to teach the KS1 mathematics curriculum. Being a hierarchical subject, where certain knowledge needs to be acquired before other knowledge can be constructed, it could reflect the progress of the students themselves who although having begun to improve, had yet to conquer some of the more difficult abstract higher levels. It could also be attributed to too little time, given that these students were undertaking only a one-year

PGCE course in which they had to address upward of ten subjects, of which mathematics although a core subject was only one. Barrington and Harries did report that a far higher proportion of the students began the course with lower rather than higher O-level grades – 48.3% achieved a C grade, 20.7% a B grade and 22.4% an A grade (n = 58). Given this greater need and the fact that time was limited, it is possible that the weaker students were unable to make up the deficit. Barrington and Harries concluded that a holistic view of the subject and the ability to see the connections leads to more effective teaching and necessitates the building up of student confidence. Interestingly the majority of teachers in responding to the open-ended items of this research reported that they believed subject knowledge to be the main factor for developing and increasing confidence (see Ch. 8 below).

There is one further area in which research has shown subject knowledge to be important – in adopting change into practice. Given the introduction of a new initiative for the teaching and learning of mathematics (see Ch. 3 above), given the importance of teachers taking on-board all aspects of that initiative, and given that in the past recommendations of good practice have not always been fully adopted into practice within the classroom (see Ch. 2 above), then the research of Irwin and Britt (in Jaworski et al ed 1999) carries some significance. They report on a two-year professional development project covering primary and secondary teachers in New Zealand. The programme was concerned with raising teacher achievement in mathematics. The teachers were categorised according to their previous training, classroom confidence, and the degree to which they progressed during the course of the project. For most a high correlation was found between the level of mathematical knowledge, confidence, and the level of progress - particularly at the higher levels, where all had a strong mathematical knowledge base. For others it was less clear.

One teacher Emily, who had a limited mathematical background at the outset, felt anxious. She believed she had regressed rather than progressed. Irwin and Britt concluded that, "the emotion aroused by her uncertainty about mathematics was stronger than her memory for the mathematics she may have learned" (p.99). By comparison, those teachers whose practice did change over the two-year period did so by reflecting on pedagogy through mathematical understanding, beliefs and values (see 4.6 & 4.7 below). Irwin and Britt drew several conclusions from this. Emily was anxious to improve her practice, she wanted to be told how to be more effective, but the project felt she should find out for herself in a way meaningful to her. She, however, did not want to expose to others her own inadequacies thereby loosing her self-respect. The project therefore ended by being a destructive rather than a positive experience. Irwin and Britt emphasised the need to help teachers such as Emily, "They need greater mathematical knowledge, together with confidence in classroom organisation, if they are to reflect on their own teaching in a way that is likely to improve it. It is unrealistic to expect them to do this, or to teach their students to reflect on mathematical ideas and processes flexibly, unless they themselves can do so." (Irwin & Britt in Jaworski et al ed. 1999, p.100)

This is important on a number of fronts. First it raises the issue of teacher beliefs with regard to teacher confidence and in the implementation of change into practice (see 4.6 & 4.7 below). As the mathematical experiences of each teacher are likely to differ – in terms of their own education, teaching, training and experiences – the philosophy promoted within the strategy could differ from the existing beliefs and practices of some teachers. This would require great change on a fundamental level for such teachers. Clearly for the teacher who like Emily lacks confidence or is insecure in her own subject knowledge, this could present a dilemma – to hold on to that with

which she is familiar or to abandon familiarity for what is required. As Irwin and Britt concluded, in the case of Emily much hinged on the style of training and support provided. The second factor it highlights is the importance not only of the training but also the design of the course - in this case vital to positive gain, where a different style of course could have had different results for Emily, a fact acknowledged by Irwin and Britt. This supports the findings of Sumner (1974) and Webb (1993 & 1994). It is also interesting given that the strategy provides one standard cascade form of training for all teachers, regardless of level, knowledge or experience. Third, it highlights the negative effect of lacking confidence, based upon a lack of subject knowledge in this case. The lack of confidence hindered the increase of competence and confidence. Fourth, it demonstrates that a lack of confidence can resist and even be stronger than long-term training (in this case a two-year course). The negative effect of not having confidence stopped the increase of competence in those teachers lacking mathematical and classroom confidence – a finding also noted in the research of Fresko and Ben-Chaim (1986).

Choat (1980) is not alone in questioning the subject knowledge of primary teachers in mathematics (Fullerton in Shuard & Quadling ed 1980, Desforges & Cockburn 1987, Alexander et al 1992, OFSTED 2000, OFSTED 2002, Earl et al 2003), "Teachers must possess the subject knowledge which the statutory orders require. Without such knowledge, planning will be restricted in scope, the teaching techniques and organisational strategies employed by the teacher will lack purpose, and there will be little progression in pupils' learning" (Alexander et al 1992, p.34). Bennett and Carre (1993) date particular weaknesses reflected through a lack of specific subject knowledge to a point prior to obtaining qualified teacher status. They argue that on entering training, students frequently lack in-depth subject knowledge

and therefore have an inadequate grasp of the connections in mathematics. Underwood and Cavendish (1997) report on concerns raised by a group of PGCE students. The students placed concerns about mathematics second only to "Differentiation / getting level right" when listing the negative influences on their professional development (from a list of twenty-four items). The group acknowledged a "lack of confidence / fear / enthusiasm of maths" as the highest negative influence, with "Confidence in teaching maths in the class" as the fourth factor of concern with regard to their teaching (Underwood & Cavendish 1997, p.21). Furthermore, as the study was undertaken towards the end of the course this reflects how these student teachers felt immediately prior to commencing teaching. Underwood and Cavendish (1997) note by way of explanation, "The major negative influence, lack of self-confidence, is commonly found among experienced teachers in relation to the teaching of mathematics and is, therefore, not a surprising result." (p.21)

The Final Report notes that schools "are more keenly aware of a need for direct support in numeracy than they are in literacy, because primary teachers tend to have less confidence about their teaching skills and subject knowledge in this area" (Numeracy Task Force 1998, p.21). Many responses during consultation raised "concerns about the need to increase teachers' subject knowledge and confidence in mathematics" (Numeracy Task Force 1998, p.20). The OISE/UT (Earl et al 2003) external evaluation of the strategies concluded that primary teachers had far greater confidence in teaching literacy than mathematics. The OFSTED (2000a) first year report on the strategy acknowledged, "many teachers recognise that they lack a secure understanding in several areas of mathematics" (p.26). The Gatsby Foundation (1995) highlighted a "lack of knowledge and confidence" (p.41) as a pointer for future action back in 1995. The Chief Inspector's Annual Report for 1993, on mathematics at KS1,

KS2 and KS3, observed that "few schools had teachers who had studied mathematics beyond the minimum professional requirement of their initial training qualifications" (p.28) and "most were still not confident mathematically" (p.28-29). As such, concerns about teacher subject knowledge in mathematics are not new. Indeed, according to OFSTED (2002), increasing the subject knowledge of teachers was a priority of the National Numeracy Strategy from the outset, "The emphasis on improving teachers' subject knowledge needs to continue" (OFSTED 2002, p.25). Whilst subject knowledge alone clearly does not make a confident or competent teacher, at the same time a teacher cannot teach what she does not know. As the Hay McBer (2000) report points out, "All competent teachers know their subjects" (p.5).

According to Wragg (in Pollard & Bourne ed 1994) when teachers have insufficient subject knowledge they need to compensate for that lack. Wragg identifies the most common coping strategies as "evasion, that is avoiding altogether subject matter not properly known, and turning children back on their own devices, asking them to improvise a solution themselves, or offering to find out for a future lesson" (pp. 217-218). The King's College Report on Effective Teachers of Numeracy noted that less effective teachers may display knowledge that is "compartmentalised; framed in terms of standard procedures, without the underpinning of conceptual links" (Askew et al 1997, p.3). OFSTED (1995) identified weakness where the teacher cannot extend pupils' learning by exploiting opportunities when they arise and concluded by reporting a key problem in supporting "teachers who lack confidence" (p.5), important given that the most effective teaching is undertaken by, "confident and skilled" teachers (OFSTED 2000 p.9). Whilst such teachers demonstrate "a confident command of the subject, a driving pace to lessons and extremely ambitious and unusually high expectations" (OFSTED 1997a, p.6), the

interim evaluation of the strategy identified weakness that "frequently related to teachers' lack of confidence and subject expertise" (OFSTED 2000, p.11) - particularly at KS2 where teachers "were considerably less confident teaching higher-order mathematics, involving the application of knowledge and skills" (p.11). The first year report identified the need for training to address weaknesses in the mathematical knowledge and understanding of some teachers (OFSTED 2000) whilst the report on the first three years of the strategy (OFSTED 2002) acknowledged that improving teachers' subject knowledge was a priority from the outset. It observes that "Teachers are becoming gradually more knowledgeable about and confident in teaching mathematics" (OFSTED 2002, p.11), but acknowledges that weaknesses remain. It is interesting therefore that the OISE/UT external evaluation of the strategies points out that "many teachers believe that the job is done, that they have the knowledge they need and have fully implemented the Strategies – a misconception that makes capacity building more challenging" (Earl et al 2003, p.6).

4.4 Confidence in the teaching of mathematics.

In addition to confidence in subject knowledge, teachers need to be confident in their teaching of that knowledge, to present the content in such a way as to develop and encourage learning. As Calderhead (1987) points out, teaching is an "active process in which teachers' knowledge provides the source of identifying and interpreting professional situations and responding to them" (p.15). Confidence in the teaching of mathematics involves having the necessary pedagogical knowledge and skills. In terms of pedagogical knowledge, the teacher for example needs to know why and how to teach, how pupils learn and how progress occurs within that learning. Shulman (1986) includes within pedagogical knowledge, the teacher's understanding of the difficulties

to be found in the learning of certain mathematics topics – what is easy to learn and what is not. As the teacher must teach the material in a way that pupils understand, then certain more difficult ideas may have to be transformed to assist that learning – adapted, interpreted, represented or tailored as Shulman suggests. Manouchehri and Goodman (2000) point to certain areas affected by pedagogical knowledge. These include assessing planning procedures, goal setting, how the teacher handles questions, dealing with student thinking, how she implements new materials, and her structuring of time. They concluded that knowledge – subject and pedagogical – determined how the teacher reflected on her practice, planned her teaching and interacted with pupils. They also noted the need to develop pedagogical understandings when taking on-board new ideas or initiatives, which clearly carries some significance for the implementation of a new strategy outlining not only what is to be taught but also how it is to be taught (see 4.6 below).

In terms of teaching skills the teacher needs for example, a variety of approaches and strategies, as well as appropriate activities to stimulate and consolidate learning. She needs to know how to make the best use of resources and which resources to draw upon. She also needs efficient classroom organisation and class management. As Good and Brophy (1977) point out, the confident and competent teacher requires a broad variety of skills to allow for 'behavioural management' as well as 'instructional management' (p.70-71). Good and Brophy report the research of Kounin (1970) who compared the management of effective and not so effective teachers with regard to pupil behaviour in class. The results showed that both sets of teachers dealt with behavioural problems in a similar fashion, however, for the more effective "their success lay in their ability to prevent and avoid problems rather than in their ability to deal with problems once they occurred" (p.70). This prevention was

attributed to the teaching skills and strategies of the teacher, thereby making a connection between pupil behaviour and teaching effectiveness. Kounin noted particular areas that contributed. The teachers were more effective in keeping their pupils working, the work itself was challenging as well as instructional, the tasks were well aimed at the needs of individuals within the class, the lessons had a good steady pace, there was high pupil involvement throughout, pupil interest was maintained and there was a high level of teacher questioning which was unpredictable in nature. Good and Brophy cite Brophy and Everston (1976) and Good and Grouws (1975) in support. It is interesting that attributes such as pace, good questioning techniques and pupil interest, are all noted by some of the teachers in this research as aspects which they believe demonstrate confident teaching (see Ch. 7 below). They are also noted in the Framework (DfEE 1999) as necessary for the confident and competent implementation of the strategy. It is also interesting that Good and Brophy refer to these teachers as having 'withitness' (p.71). If they are "with it" in their teaching then that suggests a degree of confidence, where the teacher is comfortable and secure with regard to what she is teaching and how she is teaching.

Not all teachers will, however, necessarily hold a strong pedagogical knowledge base or demonstrate a variety of appropriate and essential teaching strategies and skills. A teacher who has a good level of subject knowledge in mathematics will not automatically have a good level of teaching knowledge. She may not display the range of necessary skills. As the King's College Report on Effective Teachers of Numeracy (Askew et al 1997) noted, a degree in mathematics does not necessarily result in a confident and competent teacher of mathematics. According to Prestage and Perks (1999) some teachers hold only what they term learner-knowledge (the knowledge which pupils must obtain to pass examination, that is to say mainly

subject knowledge) rather than teacher-knowledge (subject knowledge plus the additional pedagogical knowledge and skills which the teacher needs to teach mathematics effectively). Teacher-knowledge is, for example, required to identify and address pupil problems, it is essential to extend and challenge able pupils. The HMI Report on the Teaching of Calculation in Primary Schools (2002) identified teachers who still rely too much on the use of worksheets and published schemes, whilst Blackhouse, Haggerty, Pirie and Stratton (1992) believe that all too frequently teachers teach pupils to copy and do-as-I-say rather than to understand.

In promoting a particular philosophy of mathematics education, outlining a certain approach, the National Numeracy Strategy removes several major pedagogical decisions from the teacher (see 3.2 above). Schools are expected to adopt the strategy in all its parts or be accountable. With regard to those already achieving very high standards, the Preliminary Report (Numeracy Task Force 1998a) acknowledges that they will not necessarily implement far-reaching changes to existing practice. This is, however, "not least because they are likely to be doing much of what we have in mind already." (p.49) The suggestion is therefore of one style and approach to the teaching of mathematics, for more confident and competent teaching, and for increased pupil learning. Cullingford (1995) disagrees. Whilst referring to teaching generally rather than mathematics teaching in particular, Cullingford believes there is, "no one style or personality that by dramatic gestures or flamboyance lends itself to effective teaching" (1995, p.xii). The possibility of different styles achieving highly in terms of teaching effectiveness, is not, however, fully supported in other studies with regard to mathematics. Indeed there is a large body of research which points to certain common attributes directly associated with highly effective, confident and competent teaching.

The Framework for Teaching Mathematics (DfEE 1999) for example outlines certain key elements necessary for effective direct teaching:

- directing;
- demonstrating and modelling;
- instructing;
- explaining and illustrating;
- questioning and discussing;
- developing and consolidating;
- evaluating children's responses;
- summarising.

These are further highlighted as key factors for the confident and competent teaching of numeracy in the in-service yellow box provided by the DfEE for the National Numeracy Strategy three-day teacher training days. The King's College Report on Effective Teachers of Numeracy (Askew et al 1997) also acknowledges the importance of certain teacher strategies - with regard to presentation, questioning and intervention – an importance supported in other research (Askew & Wiliam 1995, Dillon 1985). These strategies are reflected through teaching approaches which:

- affect the type of questions and their follow-up;
- outline and encourage pupils to use a range of methods appropriate to each particular task;
- encourage purposeful discussion;
- stretch and challenge all pupils;
- discuss and use the connections between different ideas and areas of mathematics;

- develop mental skills and strategies;
- use assessment to check pupil learning and determine progress (Askew et al 1997).

The similarity between those outlined in the King's College Report and those outlined in the Framework is not difficult to see. Indeed, there is also a certain resemblance to recommendations contained in the Cockcroft Report (1982) when referring to effective teaching (see Ch. 2 above) - not least the "need to establish confidence in the use of mathematics within school" (p.67). Each of these elements contributes to effective teaching and learning. The use of good questioning techniques by the teacher, for example, encourages pupils to explain their thinking behind the method of working, thereby addressing the questions why and how. It encourages pupils to think about what they have done, what they are doing and what they are about to do, putting their actions into words and thereby developing their mathematical language. It helps encourage pupils to think towards the next step or stage in their work, beyond the point already reached, and perhaps even from the particular towards the general. It also, as already seen, helps with regard to behaviour management.

The use of discussion as a teaching technique for example is not new, teacher/ pupil and pupil/pupil communication and discussion have long since been identified as important teaching strategies in mathematics – constantly emphasised within the literature (Cockcroft 1982, Cobb, Perlwitz & Underwood c.1993, Ernest 1994, Askew & Wiliam 1995). Such discussion can be formal, used within the lesson, such as in the plenary section where it may be teacher led to specific purpose. It can also be informal, undertaken amongst pupils, or with pupils and teacher, whilst in the process of activity, investigation or problem solving; it may be found in another subject area completely. Such discussions contribute to the mathematical ethos of the class, an important factor

in learning. Cobb, Perlwitz and Underwood (c.1993) studied over a five-year period the micro-culture created by the teacher and pupils within the classroom. They concluded that pupil activity, and their subsequent learning, were influenced by the "classroom community". Individual learning was inextricably related to practices within that community - where what the teacher feels about mathematics, what she portrays to the pupils, what she helps create, the discussion, communication and general interaction between the teacher and pupils, are significant. Clearly, the beliefs of the teacher concerning teaching and learning in mathematics are also likely to be important in that respect (see 4.7 below). Askew and Wiliam (1995) note a strong link between high scores and the presence of a mathematical ethos in the classroom or school. Such an ethos is unlikely to be present, however, where the teacher lacks confidence, where she dislikes the subject, or where she feels insecure in her own knowledge or in her teaching. As the Hay McBer Report (2000) emphasises, effective teachers demonstrate confidence in most situations and are optimistic and positive about their own teaching abilities.

Whilst the key elements outlined in the Framework (DfEE 1999) as necessary for confident and competent teaching comprise a comprehensive list, certain aspects that contribute to the successful mathematics lesson are omitted – such as the need to draw up lesson plans; the use of activities and resources; utilising adult helpers efficiently and effectively; controlling behaviour and timing; maintaining pace; getting around the class; assessing individual performance and needs; identifying problems; recording achievement; and noting misconceptions or areas that require attention. Bromme and Brophy (in Christiansen et al ed 1986) point to the need for certain routine strategies and skills in implementing any curriculum within the classroom. These strategies and skills are required daily and become routine over time, allowing

the teacher to concentrate more on what and how she is teaching. One such strategy for example, is ascertaining whether pupil errors are caused by a lack of attention or by a lack of understanding. The speed and degree to which such strategies develop is likely to vary from teacher to teacher, and whilst their presence does suggest some element of experience, experience will not in itself necessarily ensure their development. They are, however, likely to be acquired more quickly where the teacher is already confident in subject knowledge, where she has a variety of approaches and strategies upon which to draw, where she is knowledgeable about the pupils and their learning, and where she has the ability to move effortlessly from one aspect of the subject to another, one level to another. Such routine strategies are likely to take far longer to develop where the teacher feels insecure, where she is anxious at the slightest deviation from her planned course. The King's College Report on Effective Teachers of Numeracy (Askew et al 1997) notes that certain highly effective teachers could change from decimal notation to fractions without thinking – such was their security and strength of knowledge. Such was their level of confidence.

The success of the strategy clearly depends on teachers having the knowledge and ability to implement it as designed and required. It also, however, requires adaptability and flexibility. According to the Framework, the typical mathematics lesson should not be "a mechanistic recipe to be followed" (DfEE 1999, p.15). OFSTED (2000) observed that the most confident and skilled teachers were recognising the scope for variety within the main part of the lesson. They were using different combinations in their teaching, blending group work, whole class teaching, and paired or individual work, on different days and according to the type of the work being undertaken at the time. The Framework advises teachers to use their professional judgement on such matters. However, "Less confident teachers are uncertain about

their roles and have a view that there is a 'preferred' way of working which does not change" (OFSTED 2000, p.9-10). The ability to move around within the subject, confidently altering fundamental factors such as the way in which the class is set up or the teaching approach being used, demands knowledge, skill, flexibility and adaptability. Yet, the teacher who lacks confidence is unlikely to want to deviate far from that which she knows or from that in which she feels secure (Irwin & Britt in Jaworski et al ed 1999) (see 4.6 below). Furthermore, in order for the teacher to demonstrate such flexibility, she needs to be able to recognise that such a change is necessary, and then implement the change. The OFSTED Report (2002) on the first three years of the strategy acknowledges that more needs to be done to help teachers to think about the impact of their teaching on pupils' learning during the lesson - helping them to think-on-their-feet and adapt according to the situation.

4.5 Confidence and effective teaching.

The difficulty according to Fraser and Honeyford (2000) is that many teachers do not feel confident with regard to mathematics or its teaching, "This lack of confidence in teaching mathematics can often be a key factor in reducing effectiveness and much of the pleasure to be had from teaching and learning mathematics" (p.1). The importance of confidence to effective teaching and to higher levels of pupil achievement in mathematics has been widely noted (OFSTED 1997, Numeracy Task Force 1998, Numeracy Task Force 1998a, Frobisher, Monaghan, Orton, Orton, Roper & Threlfall 1999, OFSTED 2000, Stipek et al 2001, HMI 2002, Earl et al 2003). The OISE/UT (Earl et al 2003) external evaluation of the strategies concluded that many teachers experience weakness in knowledge and in pedagogical understanding, which limits their effectiveness. OFSTED (2000) notes that where a teacher feels uncertain about

her role she is less likely to be highly effective, "Less confident teachers are uncertain about their roles" (p.9). The danger in such cases, according to OFSTED (2000), is that insufficient attention is given to direct teaching. Instead the teacher flits between pupils, acting more in a supervisory capacity rather than teaching.

If confidence leads to more effective teaching, then it also results in higher levels of pupil learning, where the teacher's attitude is visible to pupils in what and how she teaches, "Teachers' self-confidence as mathematics teachers was also significantly associated with their students' self-confidence as mathematical learners." (Stipek et al 2001, p.213) According to the King's College Report on Effective Teachers of Numeracy (Askew et al 1997) effective teachers, those who are confident and competent in mathematics and in its teaching, help pupils to acquire knowledge of and facility with numbers and operations, based upon an integrated network of understanding, strategies and skills. They provide opportunities to help pupils apply their knowledge in a variety of contexts, thereby challenging them to think. They also encourage pupils - through discussion, listening, explaining, and through the opportunity to solve problems. In this way, they help pupils develop this network of strategies, skills and understanding - a network that helps connect different mathematical areas together, as well as linking ideas within the same area, thereby further developing pupil understanding. The report assessed effectiveness in terms of pupil improvement and learning gains, pupils were tested twice, gains were measured, and highly effective teaching identified as a result. From this those practices contributing most in the promoting of pupil learning were identified. The report did not, however, follow a cross section of the teaching profession but a selective group. The chosen teachers came from effective schools and were identified by the head teachers as themselves being effective teachers of mathematics within that school. The

measurement therefore concerned the degree of their effectiveness – be it highly effective, effective, or moderately effective – with the report seeking to identify those attributes, traits, skills and knowledge, that made some of these teachers highly effective.

Confidence helped the degree of their effectiveness in a number of ways. In the interviews "two of the eighteen teachers (both year 2 teachers) confessed that they could not immediately remember how to convert one seventh to a decimal. However despite the panic it caused them, they both felt confident that they could find out what the method was." (Askew et al 1997, p.64) They "were unashamed about loosing face, and made a positive learning opportunity of it, encouraging pupils to find out the answer before they did." (p.64) The benefits of confidence encouraged these teachers in a number of different ways. When faced with an area of mathematics they had either forgotten or did not know, confidence enabled them to turn the situation into a positive experience. It propelled them to find the answer rather than towards defeat, giving a message of perseverance - a don't-give-up, look-it-up, work-it-out message to the pupils. If pupils lack confidence "they will try to avoid challenges and show little persistence, because they believe that they are likely to fail and be 'shown up'" (Askew & Wiliam 1995, p.28) Interestingly, this point was raised by the teachers in this research who felt that confident teachers could, "tackle any situation that arises effectively", were "able to move beyond their planned lessons and able to adapt / revise spontaneously as required" (see Ch. 7 below).

There are many ways in which pupils benefit from a confident and competent teacher, "Teachers who are confident about the mathematics they teach and are enthusiastic and effective, stimulate pupils' interest in the subject" (Numeracy Task Force 1998a p.9). A confident and competent teacher "ensures that pupils' written

responses derive from their knowledge of mental strategies of calculation and from their skills in being able to explain orally how they have reached their answers" (HMI 2002) Confident and competent teachers teach in such a way as to ensure that every child in the class succeeds to his fullest potential and develops a positive attitude for the future learning of mathematics (Frobisher et al 1999, p.xi). They help determine how the pupil views mathematics, given that pupils tend to take on-board the attitude of the teacher - be it good, bad, confident or lacking confidence (Cockcroft 1982, Stipek et al 2001), teacher confidence is "significantly associated with their students' self-confidence" (Stipek et al 2001, p.213). They increase pupil achievement, where low pupil attainment in mathematics is linked to a lack of confidence (Cockcroft 1982). The positive attitude and experience of success arising further encourages pupils to keep studying mathematics at the higher levels, "those who are more confident of their ability to learn mathematics are more likely to continue studying mathematics when it becomes optional" (Askew & Wiliam 1995, p.29). Given that pupil opt-out at higher levels is a significant problem in school mathematics (OFSTED 1994, Sutherland & Pozzi 1995) and has been for some time, this link between teacher confidence and pupil confidence, and between pupil confidence and pupil achievement, would appear to be an important one for long-term mathematics education. It is interesting therefore that the OFSTED (2002) review of the first three years of the strategy notes that, whilst for many teachers knowledge and confidence in teaching mathematics has improved, weaknesses still restrict the ability of teachers.

4.6 Confidence and the adoption of change into practice.

Clearly, as Howson and Mellin-Olsen note (in Christiansen et al. ed 1986), the teacher has an important role in facilitating the introduction of beneficial change and

improvement in mathematics education, given that, "Ultimately, changes in schools happen because of the motivation and capacity of individual teachers teaching children in classrooms" (Earl et al 2003, p.138). The level of change required within the National Numeracy Strategy is, however, somewhat different to past initiatives as it requires not only the adoption of new content but also a particular approach, structure and philosophy (see 3.2 above). The adoption of philosophical change is more complex as it involves a change with regard to what the teacher believes (see 4.7 below). As such, it is clearly important that teachers, as well as feeling confident in their subject knowledge (see 4.3 above) and in their teaching of the subject (see 4.4 above), also feel confident in the new strategy – in what it promotes and in how they are expected to teach it. As Manouchehri and Goodman (2000) conclude from their research on implementing mathematical reform, "changes in teachers' practices do not occur merely by placing innovative materials at their disposal but by initiating and guiding the development of their pedagogical understandings" (p.30).

According to the OISE/UT (Earl et al 2003) external evaluation of the strategies, there are three factors that determine whether the teacher can adopt and implement change into practice:

- the teacher's motivation – the desire to want to have a go, to try something new, holding a positive attitude towards mathematics and its teaching;
- the teacher's capacity - whether she has the subject knowledge, pedagogical knowledge and skills to do so;
- an appropriate situation in which to do so - where the teacher receives support, gained perhaps through a course of training, a bank of resources and the assistance of colleagues.

The report argues that meaningful change does not occur "unless teachers are motivated to try the new practices, have opportunities to develop the relevant skills and knowledge, and work in contexts that are supportive of the changes" (p.55). Irwin and Britt (in Jaworski et al ed 1999) also identified three factors which they found affected the ability of teachers to successfully incorporate curricular and philosophical reforms into classroom practice:

- the teacher's level of mathematical knowledge;
- the teacher's level of confidence;
- how the beliefs and values of the teacher help interpret and reflect aspects of pedagogy.

They observed that when undergoing in-service training, the teacher with a strong personal mathematical base showed increased learning at the end of the course. The teacher who was without a strong base and lacked confidence, failed to incorporate any change into her practice – instead experiencing anxiety and even regression as in the case of Emily (see 4.3 above).

A closer examination of the findings of the OISE/UT report (Earl et al 2003) and the research of Irwin and Britt (in Jaworski et al ed 1999) point to much that is similar. Both note the need for the teacher to have adequate subject knowledge and teaching skills, in other words the knowledge and ability to implement the changes. Both also note the need for the teacher to have the confidence and motivation to want to try something new, to abandon that which is known for the unknown, in other words the desire to implement change. Where the two appear to differ is in the third aspect noted. The OISE/UT outline the need for a suitable context, whilst Irwin and Britt look to the philosophical beliefs of the teacher (see 4.7 below). This small difference could,

however, be attributed to the different context and situation surrounding each study. The OISE/UT inquired into the implementation of the two strategies, the National Literacy Strategy and the National Numeracy Strategy, in schools. The conceptual framework, involving motivation, capacity and situation, is therefore applicable to both strategies - as seen within the situation of the classroom. Irwin and Britt on the other hand drew their conclusions from a group of teachers undergoing a two-year course of mathematics professional development training. They looked to the factors affecting the teachers' ability to take on-board the new ideas outlined therein and adopt them within the classroom. Their conclusions therefore arise from the context of mathematics and in-service training. Given that the National Numeracy Strategy incorporated a programme of in-service training as a key factor in the developing of confident and competent practice, both are likely to hold some relevance. Also, could not the OISE/UT report already include what the teacher believes within the area of motivation and capacity? Indeed, in outlining the capacity of the teacher to implement change how can what she believes actually be excluded? How can her knowledge and the effectiveness with which she uses that knowledge in the classroom, be separated from what she believes – given that what the teacher believes has been shown through research to affect how she teaches (Ernest 1994b, Askew et al 1997, Stipek et al 2001, Poulson, Avramidis, Fox, Medwell & Wray 2001) (see 4.7 below)?

As such, with regard to the adoption of curricular and philosophical change into practice the main factors affecting that adoption centre on:

- the teacher's ability – her mathematical knowledge and skills
- the teacher's desire - her confidence and motivation

- the teacher's beliefs - concerning, for example, how and why the strategy is being implemented; its value, purpose and security of tenure; and the reality of how it can be implemented in the context of her particular situation
- the context – where the teacher has received support and training in preparation for what is required under the new system.

As Fullan (1991) points out, reform in education requires that teachers are committed to that reform rather than compliant with it, most especially if change is not only to be implemented but also maintained. With regard to the context surrounding the introduction of change, Manouchehri and Goodman (2000) conclude from research on implementing mathematical reform, that new curricular materials must include a means of preparing teachers and nurturing their professional growth in order to allow them to absorb the content, think through the connections and consider the pedagogical practices appropriate to ensure effective implementation.

Senger (1999) undertook research over a one-year period into the adoption of educational reform in mathematics at elementary school level. Arising from that research she believes that such adoption is a slow process because the teacher must first progress through a number of stages. These stages include visualising the change, verbalising it and experimenting as existing beliefs and assumptions are challenged. Having undergone the stages, however, there is no guarantee that the change will be adopted into practice. It could still be abandoned. Wilson (1998) notes the need for teachers to receive help in taking on-board new ideas and major change to practice. They need concrete images showing what it is required. Without such images, Wilson believes efforts towards implementing reform are futile. Senger (1999) also acknowledges the importance of visualising the change but sees these images as only the first step in trying to come to terms with the new ideas – interpreted in the context

of the teacher's own beliefs, arising from her past educational history and experiences. Senger identified four aspects raised by the teachers, which she found "greatly coloured the discourse, particularly in whole group meetings" (p.211). These included how comfortable the teachers were with the new ideas and practices; how confident they were that the new ideas would work; how the ideas fitted with their own existing beliefs; and how other colleagues perceived them in terms of initiatives and practice.

Desforges and Cockburn (1987) argue that it is not unusual for teachers to fail to take on board good advice. They point for example to recommendations of good practice outlined in the Cockcroft Report (1982), recommendations that had to be reiterated because previous recommendations and advice had been ignored. As these recommendations concerned how to develop more effective practice, one might have expected them to be readily adopted by teachers. The fact that they appear not to have been, despite being reiterated over a period of time and noted in several different reports (Hadow 1931, Mathematical Association 1955) besides Cockcroft (1982), raises a question as to why. Perhaps the recommendations were not received by the teacher and being unaware of what was recommended she was unable to implement them. Perhaps they were received by the teacher but misunderstood or misinterpreted and implemented incorrectly or only in part as a result. Perhaps they were received but not implemented because of external constraints beyond her control. Or perhaps they were received and understood by the teacher, but not implemented because she was unable or unwilling to do so. According to Desforges and Cockburn (1987), "When teachers do not respond positively to invitations to introduce new or refined practices, it is rarely the case that they are unaware of the invite. Rather, it is more likely that they do what all humans do. They incorporate the information they receive into their own perceptions of reality." (p.12) Desforges and Cockburn cite

the findings of Glaser, Pellegrino and Lesgold (1977) and Ausubel and Robinson (1969) in support of this argument. Indeed, Fullerton (in Shuard & Quadling ed 1980) goes even further, suggesting a particular reaction by teachers towards mathematics. The problem Fullerton believes is a general apathy amongst primary teachers towards mathematics, with teachers having insufficient knowledge regarding the subject and how it should be taught. Without the necessary knowledge and skills Fullerton argues, they are unable to implement recommendations of good practice presented to them.

That may indeed be so but it is possible that other factors could also contribute. The teacher could for example be wary of the good advice where she sees the idea as being impractical, irrelevant, or at variance with what she believes given everyday practice in the classroom. There may be constraints outside her control, for example, physical constraints (perhaps a large class in a small classroom); human constraints (such as the wishes of the head teacher or mathematics coordinator); the dictates of the curriculum (where too much is required to be covered within the available time); or even test requirements (where pressures for increasingly successful results affect decisions concerning curricular emphasis, teaching approach, even the school mathematics policy). Furthermore, having adopted upward of forty national curriculum documents, plus the Literacy and Numeracy Strategies, in eleven years, the philosophy of schools is unlikely to be one of change merely for the sake of change. Schools and teachers are likely to be reluctant to implement anything beyond what is statutorily required, or what is clearly going to greatly benefit teaching and learning. As such, recommendations may not only need to be good, but may also need to be seen to be good - effective in terms of pupil outcomes and with some sign of value prior to abandoning existing beliefs and practices. Teachers may require proof that this new

route is indeed the way forward, demonstrated through research to be the best method of teaching and learning mathematics – or at the very least, better than their existing practice. Also, given the number of curricular changes within the last ten years, it is possible that teachers may also look for some security of tenure, is it here to stay or just another document likely to be replaced in a few years, or with the arrival of a new government.

There is one further issue. According to the OISE/UT external evaluation of the strategies (Earl et al 2003) teachers adapt innovations and new ideas to suit their particular context. The report cites research by McLaughlin (1990), Huberman and Miles (1984) and Hall and Hord (2001) in support. From this adaptation, however, it notes the danger not only of weakening the initiative as a result but also the fact that this could lead teachers back to their old practices. Clearly change in itself is insufficient unless that change is maintained in the long-term. This may also be where Sumner's (1974) research is particularly important, in noting the need to reinforce change through regular training. According to Sumner, short bursts of training, no matter how brilliant, are insufficient to maintain long-term change. This also ties in with the findings of Webb (1993 & 1994) who notes that whilst short courses are beneficial, they are not great for securing major change to practice - most especially in addressing large areas such as increasing subject knowledge or changing existing teacher beliefs (see 3.3 above). Irwin and Britt (in Jaworski et al 1999) add further to this, stressing the need for certain styles of training to address different teacher situations. Indeed, Manouchehri and Goodman (2000) observed one teacher alter her teaching style when addressing areas of mathematics in which she felt confident, but revert to her old more secure approach and strategies when faced with topics in which she felt insecure. The change for this teacher was

therefore only maintained in those areas in which she felt confident. Where the teacher lacks the confidence so to do, where she is unwilling or unable to deviate far from that in which she is secure - as demonstrated by Irwin and Britt (in Jaworski et al ed 1999) and Manouchehri and Goodman (2000) - then it must be questionable as to whether any lasting change can occur.

4.7 Confidence and teacher beliefs.

The beliefs of the teacher are important to this research on a number of fronts. They are central to the research question given that this work concerns an inquiry into what the teacher believes, and confidence is a belief in the teacher's ability to be effective. They also, as will shortly be discussed, have been shown through research to affect the adoption of change into practice. Although teachers traditionally tend not to be involved in great philosophical debate, they can and do hold philosophical beliefs with regard to mathematics education - concerning what a mathematics education should comprise, how mathematics should be taught and how pupils learn. Such beliefs will have developed over time, through the course of their own education, their training and teaching - influenced for example, by their own teachers, their initial training, colleagues with whom they worked, courses they attended, the literature, research and their own teaching experiences in different school. The teachers will have determined views on why we teach mathematics, how pupils learn mathematics, what we should teach, how we should teach, what questions we should ask. According to Threlfall (in Almeida & Ernest ed 1995) the effect of a certain philosophy on teaching arises not because the beliefs concerning the nature of mathematics forces that approach, but because they suggest a certain approach to learning. It is unlikely, however, that the teacher will have established beliefs on learning without also establishing beliefs on

teaching - beliefs which could differ to those promoted within the National Numeracy Strategy and the Revised National Curriculum (DfEE/QCA 1999). Poulson et al (2001) outline the differences that can exist with regard to what beliefs are. They note, for example, that within a psychological perspective Kagan (1990) assumes beliefs and knowledge to be the same. From a philosophical perspective, however, Fenstermacher (1994) draws a distinction between each.

Increasingly in recent years the value of teacher beliefs in the teaching and learning of mathematics has become apparent (Kagan 1990, Thompson 1992, Ernest 1994, Marino 1998, Senger 1999). Research has shown a connection between the beliefs of the teacher, the effectiveness of her teaching, and pupil learning (Thompson 1992; Ernest 1994b; Askew et al 1997; Stipek et al 2001; Poulson et al 2001). As Ernest (1994b) points out, "Mathematics teachers' beliefs have a powerful impact on the practice of teaching" (p.21), where the beliefs of the teacher "strongly influence practice" (Senger 1999, p.200). "Findings showed substantial coherence among teachers' beliefs and consistent associations between their beliefs and their practices." (Stipek et al 2001, p.213) They cite the research of Clark and Peterson (1986), Fang (1996) and Thompson (1992) in support. The effect on pupil learning is also demonstrated, with a strong relationship shown between the personal beliefs of the teacher and the mathematical experience of the pupils (Almeida & Ernest 1995, Middleton 1995, Manouchehri & Goodman 1998, Stipek et al 2001). Cobb, Perlwitz and Underwood (1993) give an example when they link the beliefs and values of the teacher, reflected in the ethos of the classroom, with pupil achievement and enjoyment in mathematics (see 4.4 above). There is also the fact that those teachers who lack self-confidence and do not enjoy mathematics experience difficulty fostering confidence and enjoyment of mathematics in their pupils (Stipek et al 2001). This is supported in

other research already discussed, where the attitude and motivation of the pupil has been shown to reflect the attitude and motivation of the teacher (Irwin & Britt in Jaworski et al ed 1999, Ernest 1994). The fact that what the teacher feels about mathematics and about her teaching of it is determined by how confident she feels within the subject, could contribute significantly (Fresko & Ben-Chaim 1986). The King's College Report on Effective Teachers of Numeracy (Askew et al 1997) acknowledges that, "What distinguished highly effective teachers from other teachers was a particular set of coherent beliefs and understandings which underpinned their teaching" (p.1).

Whilst the relationship between practice and beliefs is a complex one (Poulson et al 2001), Roulet (1992) goes further. He links the style of teaching to the philosophy that the teacher holds. In this respect he associates absolutist views with a transmission style of teaching and fallibilist views with constructivist teaching. Whilst this may indeed be so, it cannot necessarily be said to always be so. Also, Roulet drew his conclusions from observations of student teachers, whose limited teaching experience could affect their knowledge, their choice of methodology and their range of strategies. Had he studied and observed a group of experienced teachers then his findings may not have been the same. In addition, Roulet fails to take into account other factors that could impact, such as the topic in hand – the teacher is unlikely to teach capacity in the same way that she teaches division. There are also the requirements of each particular school, where the school may hold expectations with regard to the way it does things and therefore the way in which it wants things done. In addition, there are factors such as the need to address an examination syllabus. Ernest (1991) notes the association between a certain philosophy and a particular teaching style, however, he points to

social contexts which could if combined with that philosophy, lead to different or even unexpected classroom images of mathematics.

Teachers judge and teach the curriculum in light of what they already know and believe, where their expertise is "closely connected to the amount and kinds of experiences they had, their personal theories on what was best for students, and their content and pedagogical base" (Manouchehri & Goodman 2000, p.39). This could have implications, given that, "Many teachers' images and beliefs about mathematics and what learning mathematics entails may be incompatible with current research and reform efforts in the field" (Senger 1999, p.200). Senger cites the research of Grouws (1992), the National Research Council in America (1989) and the National Council of Teachers of Mathematics in America (1989, 1991, & 1995) in support. Ernest (1994b) agrees, believing that the ability of the teacher to change her approach depends on her system of beliefs, "Teaching reforms cannot take place unless teachers' deeply held beliefs about mathematics and its teaching and learning change" (p.19). Fullan (1991) and Poulson et al (2001) also support this, with Stipek et al (2001) concluding that, "teachers filter what they learn through existing beliefs". The implications for the implementation of the National Numeracy Strategy are not difficult to see, given that as already noted, it would appear that teacher beliefs do not change as a result of being told. A new belief does not occur suddenly or as a single event, rather it is a thoughtful and complex process, which happens over time having travelled through several stages in its development (Senger 1999).

Whilst every teacher has beliefs and values, however, not all are highly effective. The King's College Report on Effective Teachers of Numeracy (Askew et al p.20) notes three particular aspects of beliefs influencing the effective teaching of numeracy:

i. beliefs about what it is to be a numerate pupil;

ii. beliefs about pupils and how they learn to become numerate;

iii. beliefs about how best to teach pupils to become numerate.

These resemble closely the three questions upon which Zheng (1994) believes the philosophy of mathematics education is centred:

i. what is mathematics,

ii. why we should learn or teach it,

iii. how we should learn or teach it.

Dewey (1933) highlights three types of negative belief - those based upon authority, accepted as such without question or thought by the teacher; those based upon emotion, where logic and reasoning have not been used; and those based upon reason, but with limitations arising from for example too narrow a view. By requiring a particular way of teaching, the Revised National Curriculum (DfEE/QCA 1999) is supporting the fact that teacher beliefs play a key part in teacher effectiveness. They are also, however, presenting a set of beliefs for acceptance and adoption into practice. The evidence base supporting the changes, and the particular philosophy of mathematics education promoted therein, is clearly laid down in certain areas. As Brown, Askew, Baker, Denvir & Millett (1998) point out, however, in other areas the recommendations actually run counter to the research evidence. Given that teacher beliefs are not generally quick to change (Pajares 1992), teachers can either accept the authority beliefs regardless of their own, alter practice accordingly in line with what is set out; or they can hold to their existing beliefs and teach to a different philosophy, with the possibility that they will be persuaded quickly to the benefits of what they are implementing (see Ch. 6 below). There are four problems to this last option: first, the fact that teacher beliefs are central to effective practice and to higher levels of pupil

achievement; second, the fact that it would appear that teacher beliefs do not change quickly (Pajares 1992, Ernest 1994, Poulson et al 2001); third, the fact that influencing teachers' beliefs "may be essential to changing teachers' classroom practices" (Stipek et al 2001) (see 4.6 above); and fourth. the fact that it is not clear to what degree it is possible to teach confidently and competently to one philosophy whilst holding to another.

4.8 Summary.

Through the National Numeracy Strategy the government seeks to increase teaching effectiveness and raise pupil achievement in mathematics. To that end it focuses on building up teacher confidence and competence as quickly as possible at the beginning of the strategy. In outlining the importance of confidence, the need to increase confidence and the urgency of doing so quickly, however, it provides no definition as to what it understands confidence to be. Prior to an examination of teacher perceptions and understandings regarding confidence (see Ch. 6, 7 & 8 below), it was important to examine confidence through the literature. The purpose of this chapter was therefore to explore the question of confidence and in so doing to refine and re-define the research questions. Structured in six sections, chapter four examined what confidence is. With regard to confident teaching, it looked at the need for confidence in subject knowledge and confidence in the teaching of mathematics, pedagogical knowledge and skills. Given the introduction of a new strategy for the teaching of mathematics, it also inquired into the need for teachers to feel confident in the adoption of new ideas into practice, bearing in mind that past initiatives have not always been fully taken on board. As the government outlines the need for greater confidence for more effective teaching, this chapter also looked at the link between confidence and competence.

Finally, given that what the teacher believes is central to this research question, this chapter inquired into teacher beliefs. Arising from this discussion the following conclusions were reached:

- Confidence is boldness, self-assurance and "a belief in one's ability to be effective and to take on challenges" (Hay McBer 2000, p.19). A lack of confidence concerns fear, anxiety and insecurity. Confidence is gained through overcoming that fear, anxiety and insecurity.
- Confident teaching involves the teacher having confidence in her knowledge of the subject and in her teaching of it. "Weaknesses in teaching frequently related to teachers' lack of confidence and subject expertise" (OFSTED 2000, p.11), whilst "Less confident teachers are uncertain about their roles and have a view that there is a 'preferred' way of working which does not change" (OFSTED 2000, p.9-10). The features of best teaching include "a confident command of the subject, a driving pace to lessons and extremely ambitious and unusually high expectations" (OFSTED 1997a, p.6).
- Confidence emerges as an important factor early on. PGCE students approaching the end of training acknowledged that the most negative influence on their teaching was a lack of confidence and a fear of mathematics. They listed confidence in their teaching of the subject as their fourth highest concern (Underwood & Cavendish 1997).
- The negative effect of not having confidence can stop the increase of greater confidence and competence (Irwin & Britt in Jaworski et al ed 1999, Manouchehri & Goodman 2000). Teachers with high subject

knowledge and classroom confidence were seen to progress greatly during profession development courses. Those with a limited mathematical background felt anxious, not wanting to expose their inadequacies and loose their self-respect, some even regressed (Irwin & Britt in Jaworski et al 1999). Irwin and Britt concluded that the emotion caused by the mathematical uncertainty was stronger than the memory of the mathematics learned.

- With regard to confident teaching, teachers require secure connected subject knowledge, pedagogical knowledge and teaching skills. Subject knowledge must include the connections that exist within mathematics, without which teaching could be fragmented and compartmentalised. Even effective teachers with strong subject knowledge can experience difficulty explaining the conceptual connections that exist between different areas of mathematics (Askew et al 1997). Pedagogical knowledge allows the teacher to understand that some aspects of mathematics are more difficult than others and therefore need to be transformed in their teaching so that pupils may understand (Shulman 1986).
- Secure connected subject knowledge also allows teachers to concentrate on developing other areas of their teaching, as well as allowing them the freedom to move around the subject with confidence and without worry. Yet, "existing weaknesses in the teaching of mathematics are largely concerned with teachers' subject knowledge" (OFSTED 2000, p.7). "HMI conclude with the NNS leaders in observing that teachers are not yet secure about their subject knowledge and teaching of mathematic" (Earl et al 2003, p.47).

- Teachers who lacked confidence in their subject knowledge were found to also lack confidence in their teaching ability (Fresko & Ben-Chaim 1986). This suggests a link between subject knowledge and performance in their perceptions of their own practice.
- Developing subject knowledge was found to increase confidence for a group of PGCE student teachers (Barrington & Harries 1999).
- Recommendations and new initiatives have not always been fully adopted into practice in the past (Cockcroft 1982, Desforges & Cockburn 1987). Fullerton (in Shuard & Quadling ed 1980) attributes this to insufficient knowledge regarding the subject and how it should be taught, leaving primary teachers unable to implement much of the good advice presented to them. Irwin and Britt (in Jaworski et al ed 1999) identify a high correlation between levels of knowledge, confidence and the degree of change that teachers can incorporate into their practice. Manouchehri and Goodman (2000) also draw a link between the mathematical knowledge of the teacher – subject knowledge and pedagogical knowledge – and the implementation and maintaining of change. Those who successfully incorporated change did so by reflecting on pedagogy through mathematical understanding and through their beliefs and values concerning mathematics education (Irwin & Britt in Jaworski et al 1999).
- Beliefs and values are a key factor in adopting new ideas, altering practice and developing confidence in the new system. Changing teacher beliefs is, however, a slow and complex process, during which teachers progress through a number of stages - visualising the change, verbalising it, and

experimenting in practical terms as they try to come to terms with the new ideas through the context of their old beliefs and educational history (Senger 1999).

- Certain beliefs are visible in highly effective teachers – beliefs about what it is to be a numerate pupil; beliefs about pupils and how they learn to become numerate; and beliefs about how best to teach pupils to become numerate (Askew et al 1997). These beliefs will have been established over a period of time, through the course of the teacher's own education, training and teaching.
- By requiring a particular way of teaching, the Revised National Curriculum (DfEE/QCA 1999) is supporting the fact that teacher beliefs concerning what mathematics is, and how and why we teach it, play a key part in teacher effectiveness. They are also, however, presenting a set of beliefs to which some teachers may not hold. What are the implications for a teacher who holds a different set of beliefs given that there are certain philosophical and pedagogical expectations attached to the strategy? Some could find themselves having to adopt this philosophy in conflict with their own (see Ch. 6, 7 & 8 below).

In conclusion, confidence is vital to teaching and learning in mathematics as it affects the attitude of the teacher towards mathematics and towards its teaching (Buxton 1981, Bell et al 1983). Confidence affects how the teacher feels about her teaching (Fresko & Ben-Chaim 1986). It affects how successfully she adopts new ideas into practice (Irwin & Britt in Jaworski et al ed 1999, Senger 1999, Manouchehri & Goodman 2000). It affects pupil attitude (Burns 1982, Askew & Wiliam 1995) and performance (Earl, Fullan, Leithwood, Watson, with Janzi, Levin & Torrance 2000; Earl, Fullan,

Leithwood, Watson with Janzi, Levin & Torrance 2000a). It also affects teacher competence (Underwood & Cavendish 1997, Numeracy Task Force 1998, OFSTED 2000). Successful reform depends greatly on the teachers' role in that reform (Dorfler & McLone in Christansen et al ed 1986, Ernest 1994). The effectiveness of any change to the syllabus or curriculum is also dependent on the teacher, her willingness to accept and her willingness and ability to adapt to the change and take it fully and confidently on board (Dorfler & McLone in Christansen et al ed 1986, Senger 1999, Manouchehri & Goodman 2000). As such, it is also important that the teachers welcome the National Numeracy Strategy and hold positive expectations (see Ch. 6 below).

Several connections emerged during the review of the literature and in the course of this discussion, connections with implication for this research. As such, they require further inquiry and discussion in light of what the teachers in this research believe concerning their degree and effect (see Ch. 6, 7 & 8 below). They include:

1. the link between confidence and competence;
2. the link between confidence, pupil attitude and pupil achievement;
3. the link between confidence and the ability of the teacher to adopt new ideas into practice;
4. the link between teacher subject knowledge and teacher confidence;
5. the role of teacher beliefs with regard to confidence in mathematics, mathematics teaching, and the implementation of a new strategy.

Chapter 5: The methodology.

In the preceding chapters I have outlined the background to this research question, looking at the historical context from which the National Numeracy Strategy and the Numeracy Task Force focus emerged (see Ch. 2 above). I have examined the National Numeracy Strategy itself, what it contains, what it expects, its philosophy, approach, structure, focus and the form of planning incorporated therein. I have also considered the programme of teacher in-service training allocated by the government alongside. In so doing I have outlined the context in which teacher confidence was expected to grow (see Ch. 3 above). I have also explored the question of teacher confidence in mathematics through the literature, given that no definition was presented within the strategy with regard to what confidence is and how it is manifested in practice (see Ch. 4 above). As a result of this discussion, and a refining and redefining of the research questions through the literature, this chapter now outlines the methodology for this work.

Despite the vital role of the teacher in implementing an effective curriculum it is only in recent years that the views and thoughts of practising teachers have come to the fore (Day, Pope & Denicolo 1990). Indeed, according to Nelson (in Day, Calderhead & Denicolo ed 1993), "it is still acknowledged that teachers' voices are muted and their perspective overlooked in the knowledge base about teaching." (p.151). Given that effective teaching and learning in mathematics is dependent on an effectively taught curriculum, then what the teacher believes, what she perceives and what she understands - with regard to confidence and its role in mathematics education - is clearly of great importance. In accepting the Task Force focus the government highlighted the importance of confidence, the fact that confidence needed to be

increased, and the urgency of doing so quickly at the beginning of the strategy. The fact that they believed it to be so does not, however, necessarily make it so. Teachers may not agree. They may not believe confidence to be important to how they teach and how pupils learn, to how they as teachers feel about the subject and their teaching of it. They may not believe that they lack confidence and may see no need or urgency in its building up.

This work inquires into how teachers conceptualise confidence, ascertaining what they understand confidence to be and how they perceive it affecting their practice. This inquiry arises from the fact that the Numeracy Task Force identifies confidence as one of two key factors for more effective teaching and learning in mathematics (see Ch. 1 above). The Task Force emphasises, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy."(Numeracy Task Force 1998, p.2) In so doing, however, the report fails to define and address fundamental questions such as what confidence is, how it is manifested, what it affects and what affects it – questions which are addressed through the responses of the teachers in the coming chapters.

On the basis of a range of views expressed by the teachers in written and verbal form through three questionnaires and two focus group discussions, this work inquires into:

- what the teachers believe confidence to be;
- whether, and if so the degree to which, they feel confidence is important to their practice;
- how they believe confidence affects their practice.

As the Final Report (Numeracy Task Force 1998) notes not only the importance of confidence, but also the need to increase levels quickly, this work also inquires as to whether the teachers –

- believe this focus to be necessary;
- believe they lack confidence, and if so, the degree to which they perceive that lack and why.

In addition, given that the government provides a programme of training and support through which confidence can be built-up, this work assesses –

- what the teachers believe the impact of the strategy on confidence to be.

Prior to embarking on an analysis of the views of teachers on these questions (see Ch. 6, 7 & 8 below), however, this chapter outlines the methodology for this work with regard to research design, data collection and data analysis.

5.1 The research design –

a. Possible problems arising within this research:

A number of problems emerged during the course of the research. First was the fact of limits within the existing literature with regard to the question of teacher confidence and primary mathematics, already discussed (see Ch. 1 above). I was aware, at the outset, that not much had been recorded on this aspect of mathematics education. As such certain limits with regard to confidence and primary mathematics came as not entirely unexpected. Indeed, this was one of the reasons why I felt confidence to be an important area for inquiry in the first place, having been highlighted within the National Numeracy Strategy as one of two key factors affecting higher levels of pupil achievement and more effective teaching. I was not,

however, expecting limits to also emerge within the field of confidence and mathematics, and even within the general area of confidence and teaching. Furthermore, bearing in mind the importance placed upon confidence by the Task Force (Numeracy Task Force 1998) and government, and given the fact that no definition was provided, it was possible that more literature might emerge and might have been expected to emerge during the course of this work. As already noted, these limits meant that I had to be aware of the possibility of gaps emerging within the knowledge base during the course of this work.

A second problem, but also a benefit in other respects, concerned the timing of the research. This research was specifically designed to cover the period surrounding the introduction of the National Numeracy Strategy. As such, and given that it commenced in October 1998, it was well timed to follow the strategy before, during and immediately after implementation. That being said, with the many curricular changes taking place during that four year period (the introduction of the National Literacy Strategy in September 1998, the National Numeracy Strategy in September 1999, the Revised National Curriculum in September 2000) and with pressures on teachers to implement these changes quickly, there was a strong possibility that the teachers may not wish or may not have the time to participate in this research. Given that I was looking for a range of views in order to explain what teachers understand confidence to be and how they perceive it affecting their practice, this could have had implications. Additional data could subsequently have been collected but I was trying to time the collections around certain time frames – the first collection of data took place one-term before implementation, the second one-term after, and the third one-year later. The fact that a second follow-up collection of additional data proved unnecessary perhaps reflects the strength of feeling that teachers hold on this issue.

It could also reflect their keenness to partake in research on issues that directly affect them. Or it may demonstrate their appreciation at having the opportunity to do so. Alternatively it may well be that they just had something to say and took this opportunity to say it. Regardless as to why, it is interesting that there was one particular issue raised by the teachers themselves, later to be discussed (see Ch. 8 & 9 below), an issue neither expected nor raised by the author, nor suggested in any of the items within the questionnaires. It arose as a result of the focus group discussions in which aspects of this research work were debated by two groups of teachers (see 5.2e below). Following on from the discussions some of the teachers who had partaken commented in questionnaire 3 on the fact of feeling alone in their thoughts, concerns and worries; singular in facing problems. They felt reassured from knowing that others held similar views, felt as they, experienced similar problems and were confronted by similar worries (see 8.6 & 9.10 below). This was also raised in informal conversations after the discussions.

One further aspect, in writing-up this research certain decisions were made at the outset in order to add to the flow and provide comfort in reading. The first concerned gender. All teachers within this work are referred to in female terms. This does not assume all teachers to be female, nor all respondents in the questionnaires to be so, nor does it assume that conclusions apply only to female teachers, it is simply a means of avoiding the constant he/she situation in writing. Similarly, all pupils are referred to in the male form, the opposite of the teachers, for ease of writing and reading.

b. The general approach to this research work:

In approaching this research as a whole, a research plan and timescale were drafted at the outset. Both were influenced by timings for the introduction of the National

Numeracy Strategy, affecting as they did the distribution of the questionnaires. The program for this research was roughly based on the stages of research outlined by Ernest (1994), namely:

- defining the problem, question and area of research;
- undertaking a review of the literature;
- formulating the hypotheses and context of inquiry;
- implementing the research plan;
- determining the results;
- assessing the significance of the results;
- outlining the implications of the research and its findings for mathematics teaching;
- assessing the project and its significance for the researcher.

These stages also correspond to those outlined by Hitchcock and Hughes (1989) who identify:

- the research design and preparation stage;
- the data collection stage;
- the data analysis and evaluation stage;
- the period of writing-up.

c. The research plan:

Arising from this a research plan, specific to this particular work, was drawn up. It allowed for five main stages in the research process:–

- defining the research question, identifying the research questions and drawing up the research plan with regard to explaining primary teacher

conceptions of confidence in mathematics;

- identifying and reviewing the literature on confidence in mathematics and redefining or refining the questions where necessary;
- drawing up and implementing the three questionnaires, the means whereby data was to be collected;
- analyzing the data to determine the results, their significance and implications for teaching and learning in mathematics, validating the results through the focus group discussions;
- assessing the project and its significance, looking to aspects arising and possible areas for future research.

Although listed as five separate stages, there had to be flexibility within each to allow for cycles and overlaps. For example, the first and second stages commenced together at the outset. The review of the literature (see 5.2a & 5.2b below) then continued throughout the entire research period as not only had it to be current but, being a period of great change, new publications were constantly being brought out. With regard to data collection and data analysis, they also formed a cycle where having identified and outlined the issues, the collection of data began with questionnaire 1 pre National Numeracy Strategy implementation. Upon receipt back, data was analyzed and the issues refined. More data was then collected through questionnaire 2, one-term post strategy implementation. Again it was analyzed, compared and contrasted, and the issues refined or redefined as a result. More data was then collected through questionnaire 3, one-year later. This helped refine the central questions and also added to the reliability and validity (see 5.2f below) of the

research. Findings were presented to teachers within the two focus group discussions. In this way earlier data was again validated and additional data received to add to that received from questionnaire 3.

As this research was concerned with teachers conceptions of confidence, what they understand confidence to be and how they believe it is manifest in practice, it required not a survey but qualitative data from which a broad range of opinion could be obtained. A range of responses provided a fuller picture. It allowed general patterns and more individualistic attitudes to be identified. An examination of other research into teacher beliefs demonstrated two ways through which the data could be collected – in verbal or written questioning form (discussed at 5.2b below).

The initial plan was to obtain the views of a small group of teachers (by questionnaire), followed by a case study of four teachers (by way of small questionnaire coupled with interview). Two factors, however, slightly altered this decision as the research progressed. The first was unexpected limits emerging in the review of the literature with regard to the question of teacher confidence in primary mathematics (see Ch. 4 above). This highlighted the importance of looking at the wider picture and of ensuring that I obtained a broad range of opinion on this question. This I felt could best be ensured by obtaining the views of a larger number of teachers than the originally planned four teachers, who although they might provide a range of opinion, might not due to the small number. The second factor emerged from the responses of the teachers expressed in questionnaire 1. These responses suggested the possibility of a larger-scale problem than was previously anticipated by myself, and indeed by the government as reflected and addressed in the allocated National Numeracy Strategy three-day training package (see 6.2 below). Given that possibility, it reinforced the importance as I saw it of obtaining a

wide range of opinion from the teachers on this question. It also confirmed my decision to enlarge the case study at the second stage of data collection (questionnaire 2). I decided to include verbal discussion at the third stage (focus group discussions), again with a larger group of teachers. By using focus group discussions I hoped it would provide the opportunity for teachers to spark off each other, when agreeing or disagreeing with views expressed by others in the group or with the emerging conclusions from this research (see 5.2e below).

d. The timescale:

A timescale was drawn up, commencing October 1998, and deliberately timed to cover the introduction of the National Numeracy Strategy. With regard to the collection of data the timetable hinged on a number of factors, not least timings of strategy implementation and training, as well as the specific objectives of each questionnaire (see 5.2d below).

Fig. i: The timescale for this research work.

Autumn Term 1998:
Determine the research question, the area of research and the approach
Draw up the research plan and the timescale
Begin the review of the literature

Spring / Summer Term 1999:
Contact eight Local Education Authorities, identify a variety of schools
Attend the three-day National Numeracy Strategy training course as an observer
Speak informally with teachers, Numeracy Advisors and Numeracy Consultants
Draw up and pilot questionnaire 1, aimed at determining the situation prior to National Numeracy Strategy implementation
Despatch Questionnaire 1 (May / June) to 90 teachers in a variety of schools

Summer / Autumn Term 1999:
Sort, order, record and analyse data from Questionnaire 1 for preliminary findings
Identify, refine or redefine the issues for follow up in Questionnaire 2
Draw up and pilot Questionnaire 2, aimed at gathering views on teacher

confidence and the situation post strategy training and implementation
Despatch Questionnaire 2 (December / January) to 169 teachers

Spring / Summer Term 2000:
Sort, order, analyse, compare and contrast the data from Questionnaire 2
Examine the longitudinal study of two teachers responding to questionnaire 1 and 2
Assess the necessity for a third questionnaire or for teacher discussions
Identify, refine or redefine the issues for follow up in Questionnaire 3

Summer / Autumn Term 2000:
Draw up and pilot Questionnaire 3, this is aimed at providing data one-year post strategy implementation and at giving support to the emerging findings
Identify issues and stimuli for the two Focus Group discussions, aimed at validating the emerging conclusions and providing some additional data

Autumn Term 2000:
Attend the five-day training course, both as observer and participant, speak informally to teachers, Numeracy Advisors and Consultants attending
Hand out Questionnaire 3 (October and November) to 46 teachers attending the final day of the five-day National Numeracy Strategy training course
Undertake two Focus Group discussions (October and November), with approximately 23 teachers and subject coordinators partaking in each

Spring / Summer / Autumn Term 2001:
Sort, order and analyse the data from Questionnaire 3 and the Focus Groups
Compare and contrast all of the data from the three questionnaires and discussions
Finish writing-up
Assess the project, its findings and the implications for mathematics education

e. The research question:

This work aimed to explore teacher conceptions of confidence in primary mathematics. This research question arose from the Task Force focus highlighting confidence as one of two key factors necessary for more effective teaching and higher levels of pupil achievement in mathematics. Through its acceptance of the Final Report (Numeracy Task Force 1998) the government noted the importance, the need and the urgency of building up confidence. The fact that the government believe it to be so does not, however, mean that teachers will automatically or necessarily be in agreement - they may not believe confidence to be important, they may not see it as lacking, they may not acknowledge the need to increase it. One further factor, although

noting its importance, the Task Force failed to define confidence - what they understand confidence to be or how it is manifested in practice within the classroom. As such, on the basis of a range of views expressed by the teachers in written and verbal form, by way of three questionnaires and two focus group discussions, this work inquires into -

- What the teachers believe confidence to be - What do they understand confidence to be in terms of their teaching and pupil learning? What makes a confident teacher?
- Whether, and if so the degree to which, the teachers believe confidence to be important to their practice - How do they perceive confidence in terms of how they teach, how they perceive their teaching, and in terms of pupil learning? Does confidence have any importance beyond the Numeracy Task Force focus?
- How the teachers believe confidence affects their practice – How is confidence manifested in their teaching and in pupil learning? What does confidence affect? Does it affect how the teacher teaches, how she feels about the subject, how she perceives her practice? Does it affect how students feel about mathematics, their attitude and achievement in the subject? Also, given the introduction of a new strategy for the teaching and learning of mathematics, does it affect the ability of the teacher to successfully adopt change into practice?

As the Final Report (Numeracy Task Force 1998) notes not only the importance of confidence, but also the need to increase levels quickly, this work also inquires as to -

- Whether the teachers believe this focus to be necessary, whether they believe they lack confidence, and if so, the degree to which they perceive that lack and why – Do the teachers believe the Task Force focus is necessary? Do they perceive a lack of confidence amongst colleagues, generally speaking? Do they believe that they personally lack confidence? What aspects or attributes affect confidence? To what do the teachers attribute a lack of confidence?

In addition, given that the government provides a programme of training and support through which confidence can be built-up, this work also assesses –

- What the teachers believe the impact of the National Numeracy Strategy to be on teacher confidence – Has National Numeracy Strategy training increased teacher confidence with regard to mathematics and their teaching of it? Has National Numeracy Strategy implementation increased teacher confidence? If so, then what factors do the teachers believe contributed most to that increase?

5.2 The collection of data –

a. Preparation and courses:

As already noted, the National Numeracy Strategy carried an allocated training programme. As part of this programme, three-day courses disseminated directly to head teachers and subject coordinators the wishes and requirements of the government. These coordinators then had responsibility for passing that package and requirements on to staff in their school – a cascade method of training (see 3.3 above). As this three-day course stemmed directly from the government, it provided a primary source of information on what they understood numeracy to be within the context of mathematics, the strategy, and government wishes concerning its implementation in the classroom. It also gave an indication of what information the

government deemed most necessary for schools and teachers, both as a means of preparing them for strategy implementation, and for building-up confidence and competence quickly at the beginning of the strategy. I therefore felt that it was important that I attend, in the capacity of an observer, so that I too could experience the package first-hand - as indeed some of the teachers within this research also would. One further factor contributing to my decision to attend was the fact that it was quite likely that reference might be made by the teachers to this training programme, or to aspects of it. This reference could be made when expressing views in the questionnaires, through informal discussions throughout the research period, or within the focus group discussions. It could be made in respect of their own attendance, their interpretation of what had been presented to them by the mathematics coordinator in their school based upon her attendance, or even through the material and resources presented or promoted therein for use within their class mathematics lesson. As such, I felt that my attendance could provide information as well as a base for interpreting the views of the teachers in this research. My attendance would not, however, necessarily help determine the quality of the training, for although based upon a standard package differences could occur through the quality of the presentation.

For similar reasons, I also decided to attend two five-day training courses, again in the capacity of an observer for most of the time but also as participant. Again, attendance at the course provided first hand experience of the training received by the teachers, in terms of what was provided and how. It showed where the emphasis was being placed, given that the OFSTED (2000) review of the first year of the strategy noted the need for more training to address gaps in teacher subject knowledge, "Weaknesses or gaps in the subject knowledge of many teachers

were key concerns in the interim report. The five-day course undertaken by an increasing number of teachers has played a significant part in increasing the confidence and knowledge of the participants" (p.16). Attendance at these courses also allowed me the opportunity to discuss formally and informally with those attending – teachers from a variety of different backgrounds and including subject coordinators, head teachers, class teachers, consultants and advisors – on questions such as confidence, what they feel is needed, what is offered, what is received and also of course on aspects of this research as it progressed. These conversations proved very valuable. I recorded key points of all such discussions in field note form and used them to assist in formulating the questions.

b. The form of data collection:

The collection of data followed a questioning format. Within that format, and given a small-scale qualitative study from which I required a broad range of teacher opinion, it was possible to adopt either a questionnaire or interview approach. Both have been used in research on similar areas of inquiry where the collection of teacher beliefs and opinion was the central issue. For example, Barrington and Harries (1999) used questionnaire for their research, "An exploration into the mathematics subject knowledge of students on QTS courses", which concluded that confidence increased as subject knowledge increased. Stipek et al (2001) also used questionnaires for researching "Teachers' beliefs and practices related to mathematics instruction", in which "Teachers self-confidence and enjoyment of mathematics and mathematics teaching were also assessed" (p.213). Stipek et al (2001) followed their questionnaire with video taping of the teachers' teaching as the second part of their inquiry into the relationship between beliefs and instruction.

I followed up with two focus group discussions, where as Wellington (1996) points out, the teachers could 'spark' ideas off each other. By combining questionnaire with focus group discussion, I gained data in two different forms (as did Stipek et al 2001) – the written and verbal.

Both interview and questionnaire could have provided a suitable method for gathering qualitative data on this question. The decision to adopt open-ended items in a questionnaire format, however, stemmed from a combination of reasons based upon the particular needs and resources of this project. First, although small-scale research, the questionnaire allowed the opinions of more teachers to be gathered, with greater ease, more quickly and cheaply, in a shorter time frame (Fink 1995, Oppenheim 1996, Wellington 1996, Bell 1999). It allowed a variety of teachers, from different education authorities, varied backgrounds and a variety of schools, to be questioned, thereby encompassing a wider geographical area – an advantage of the questionnaire form, as Oppenheim (1996), Bell (1999) and Wellington (2000) point out. I had been asked to use teachers from the GWIST area (the funding body) as part of the research group but supplemented this with teachers from other education authorities to allow for slight differences in strategy training, approach and provision - although I did not intend analysing the data from a geographic viewpoint. One uniform training package had been provided (see 3.3 above), it was, however, possible that differences could still emerge from the training providers. (It might have been interesting to have distinguished between the GWIST group and non-GWIST teachers, thereby allowing an analysis of the training providers, however, that was not the purpose of this research and the research question was in itself already a sufficiently large area.)

One further reason for choosing the questionnaire format was that it separated the teacher from the questioner (Youngman in Bennett et al ed 1994). This had several

benefits for an inquiry into teacher beliefs (Evans 1984, Fink & Rosecoff 1985, Fink 1995, Wellington 1996, Bell 1999, Peterson 2000, Wellington 2000). First, it gave anonymity should the teacher so wish it, and almost all did. Oppenheim (1996) notes an advantage of anonymity, in increasing response rate. Sommer and Sommer (1991) also point to an advantage in investigating sensitive issues, attitudes or behaviours. Second, it placed no pressure on the teacher to respond to an item quickly, given that the questioner was not waiting for a response or to pose the next question. This allowed time to think, to consider the various permutations, options and scenarios; time to look back to past classes, schools, colleagues, particular situations and experiences. The interview would have allowed time but some teachers may have felt under pressure not to delay excessively. Third, it provided exactly the same input for each teacher in terms of question order, language, expression, tone and emotion (Youngman in Bennett et al ed 1994, Wellington 1996, Bell 1999) – an important fact according to Oppenheim (1996). In undertaking interviews, the voice intonation of the questioner could have varied over a period of days or even weeks. Fourth, there was the question of body language, where the questioner could unintentionally have added something to the question – a slight smile, nod, questioning look or quizzical glance (Fink & Kosecoff 1985, Nelson in Day et al ed 1993, Wellington 2000). There is some difficulty in remaining detached, presenting a uniform image, in a face-to-face situation. On the other hand, in an interview were the interviewer not to respond in any outward fashion the teacher may see this negatively, interpreting it as coldness, unresponsiveness or disinterest – which could impact on her attitude towards the interview, and her response as a result.

Nelson (in Day et al ed 1993) points to a further advantage in choosing the questionnaire format, the fact that it lessens the tendency for teachers to respond and

say what they think we want to hear about their profession. This could arise where the teacher looks for approval, tries to read the questioner and respond as she thinks the questioner wants her to respond – important given that this research inquired into a sensitive area of teacher opinion. There is also as Nelson points out the desire for understanding or sympathy from the interviewer by the interviewee. Assuming that the questionnaire is robustly drawn up, the anonymous written response offers neither approval nor disapproval, carries no expectation of response, no understanding by the questioner, no sympathy.

A disadvantage of the questionnaire format generally speaking is the lack of follow-up, being unable to ask 'why' afterwards (Wellington 1996, Bell 1999). Oppenheim (1996) adds to this, noting no opportunity to correct misunderstanding or probe. Being aware of this I took steps at the outset. First, the open-ended items of questionnaire 2 most specifically sought qualitative data, asking teachers to 'explain', 'define', asking 'why' and 'how' (see 5.2c below). All three questionnaires asked the teachers to explain why they responded in a particular way, encouraging them to give examples and to add to their answers. Second, I took opportunities throughout the research to speak informally with teachers on aspects of the research, for example whilst attending courses and during the piloting period for the questionnaires. Third, I included two focus group discussions towards the end of the research (see 5.2e below) to address and discuss outstanding questions, clarify misunderstandings, and to allow the question 'why' and 'how' to be posed.

c. The three questionnaires:

This research aimed to examine teacher understanding of confidence, what the teachers perceive confidence to be and how they believe it affects their practice. The

teachers' opinions were expressed in written form through three questionnaires and in verbal form through two focus group discussions, providing mainly qualitative data but some quantitative data in support. The collection of data went from one-term before National Numeracy Strategy implementation to one-year post strategy implementation.

Questionnaire 1: Questionnaire 1 (see appendix i) was undertaken one-term before the introduction of the National Numeracy Strategy. It aimed to establish the context and situation pertaining at the time of its commencement. As the first of the three questionnaires in this research, it sought to ascertain facts concerning teacher confidence and mathematics education immediately prior to the adoption of new content, structure, approach, style and philosophy into practice. It also aimed to describe how the teachers in this research expected the implementation of the National Numeracy Strategy to change their practice, their confidence in mathematics and in its teaching, as well as their beliefs concerning mathematics education. Whilst the knowledge of the teachers concerning the strategy was expected to vary, it was felt that most would have some indication of what it entailed given that the Framework for Teaching Mathematics (DfEE 1999) had already been distributed to schools. Many of the teachers had also undergone some of the allocated training.

To that end, questionnaire 1 inquired into the expectations of the teachers concerning the strategy - whether they welcomed the National Numeracy Strategy; whether they believed it to be necessary; whether they expected it to change their beliefs and values concerning mathematics teaching and learning; and whether they expected it to change how they teach. It also examined the context immediately prior

to, and preparations for, strategy implementation - the situation pertaining at the time; what the teachers demonstrated about their attitude and beliefs towards the National Numeracy Strategy. Being the first of the three questionnaires I hoped that it might identify aspects, questions or issues for follow up in questionnaire 2 (see appendix iii) – such as whether the teachers expected their practice to change as a result of strategy implementation; what they thought of confidence; and whether they believed that confidence was linked to teaching competence. With the connection between confidence and competence having already been established through the review of the literature (see Ch. 4 above), I deliberately asked the teachers to assess their confidence and their competence separately. I also distinguished between the different key stages and addressed each attainment target separately. This would allow comparisons to be drawn between levels of each. It would show degrees of movement. The teachers were also asked their views with regard to strategy training to date, given its importance to the strategy and to building-up confidence and competence, but bearing in mind that most had not completed that training and so provided in incomplete picture.

In the main, the teachers responded by 'circling' one of several given options, by 'ticking' the relevant box, by 'rating' according to importance or priority, by recording examples and by providing other suggestions in addition to those already given (see appendix i). Questionnaire 1 was an anonymous questionnaire – unless the teachers wished to record their name for follow-up and of the thirty teachers who replied several did. To these teachers was also sent questionnaire 2. By doing so, these teachers allowed a longitudinal study to be undertaken with regard to their responses to both questionnaires (see 8.5 below).

Questionnaire 2: Questionnaire 2 (see appendix iii) explored the teachers' understanding of confidence. Undertaken one-term post National Numeracy Strategy implementation, it sought to establish through a series of open-ended items what the teachers believe personally as well as what they perceive generally with regard to confidence - in terms of their mathematics, their mathematics teaching, how they perceive that teaching and its effect on pupil learning. Through a range of views recorded in the teachers' own words, questionnaire 2 addressed a number of 'why' and 'how' questions regarding confidence. These included important items central to this research such as – how would you define confidence, how does confidence affect practice, why do teachers lack confidence, how can confidence be built-up?

Bearing in mind the limits that emerged during the review of the literature (see Ch. 4 above) and also seeking to address the main research questions (see 5.1e above), questionnaire 2 inquired into several fundamental areas concerning confidence. It explored what the teachers understand confidence to be, how they believe confident teaching is manifest in practice, what factors they believe affect confidence, and what is affected by confidence? In this way and on the basis of a broad range of responses from sixty-one teachers it aimed to explain how these teachers conceptualize confidence. Given the Task Force focus and the possibility that the teachers might be in agreement with that focus - acknowledging a lack of confidence, the importance of confidence and the need to increase it quickly - it also inquired as to whether the teachers believe that a lack of confidence exists in mathematics and of so, to what they personally would attribute that lack.

Certain items were also included from which comparisons could later be drawn either within the same questionnaire or across two questionnaires. For example, when inquiring into confidence levels (questionnaire 2) two questions were posed.

The first concerned the teachers' lack of confidence personally, whilst the second concerned how they perceived the situation generally. This allowed comparisons to be drawn between how these teachers perceive confidence levels generally and on a personal level – given that it could not be assumed that they would necessarily be the same. A further example concerns the effect of the strategy on confidence. Again two questions were posed, one inquired into the effect of strategy training on confidence, the other on the effect of strategy implementation on confidence – given that the National Numeracy Strategy encompassed two means through which confidence could be increased, training and implementation of the strategy itself. Questionnaire 2 also included several items on increasing confidence - whether the teachers believed that confidence had increased, what they felt contributed to that increase, how they believed it could best be increased, whether they felt a further increase was still necessary and if so, in what way. This was posed in more than one item so as to allow a cross-analysis of responses, thereby re-enforcing the conclusions and providing additional information from another aspect. It could also allow comparison with the literature, given the research of Underwood and Cavendish (1997), Barrington and Harries (1999) and Irwin and Britt (in Jaworski et al ed 1999). Questionnaire 2 was answered anonymously by all but two of the teachers, sixty-one teachers answered in total.

Questionnaire 3: Questionnaire 3 (see appendix v) was undertaken towards the end of the research. As such, it provided validation for the emerging conclusions as well as additional data one-year on. Its value was also greatly increased by the accompanying focus group discussions undertaken alongside (see 5.2e below), with the same teachers partaking in both. Much briefer than questionnaire 1 or 2 with only eight key questions, but following on from the discussions, it was well placed

to assess whether any increase in confidence had been maintained. It also allowed an assessment of how the teachers perceived the impact of the National Numeracy Strategy on teacher confidence, one year after implementation and therefore at a point when the strategy should have been well established and more familiar. Questionnaire 3 was undertaken after the focus group discussions with the same forty-six teachers partaking (there were twenty-five teachers in the first focus group, twenty-one teachers in the second). I expected that the discussions, in highlighting some of the issues, would make the teachers more aware in their responses. As in the other two questionnaires no names were required.

In deciding on which items to include, certain of the earlier questions in the other questionnaires were repeated, for example, with regard to levels of confidence at each key stage. This was deliberate. In some cases it sought to assess any change or improvement impacting from the strategy over a longer period of time, for example in asking whether the teachers felt that a lack of confidence existed. In other cases it was to confirm a response on a key issue at a later point in time and with a different group of teachers, for example when asking whether they welcomed the National Numeracy Strategy. Some questions were based upon conclusions and recommendations already reached, for example with regard to the need to increase teacher subject knowledge in order to increase teacher confidence. Another question sought to ascertain whether confidence had increased and whether greater confidence was still required in respect of the four main areas already identified from the teachers' responses to questionnaire 2 – the teaching of mathematics, mathematics subject knowledge, the strategy itself, and the Revised National Curriculum (DfEE/QCA 1999).

d. The sample and distribution:

As a small-scale qualitative research work seeking to explain how teachers conceptualise confidence, this research required a broad range of responses. The choice of schools, made from listings issued by the various education authorities, was therefore deliberately mixed to include a variety of schools: large, medium and small; country, town and city based; primary, first, junior, middle and combined. It covered seven Local Education Authorities across the south of England including city and rural: Gloucestershire, Wiltshire, Swindon, Somerset, Devon, Hampshire and Portsmouth. The respondents ranged from experienced to newly qualified teachers, from class teachers to the Special Educational Needs coordinator, mathematics co-ordinators to head teachers, reception through to year 7. Questionnaires 1 and 2 were both posted to schools with a covering letter addressed by name to the head teacher. This as Wellington (1996) and Oppenheim (1996) suggest can help increase response rate. The choice of who responded was left to the school and its teachers. To the best of my knowledge, the only variable distinguishing the respondents from other teachers was their willingness to participate in the research. A minimum of three questionnaires was sent to each school, with larger schools receiving more. Certain steps were also taken to maximise return – using coloured paper to make it stand out; addressing the head teacher by name rather than a general 'Sir or Madam'; explaining the research, its background and purpose in a standard covering letter; and including a stamped addressed envelope for each questionnaire (Evans 1984, Fink 1995, Oppenheim 1996, Wellinton 1996, Bell 1999).

Questionnaire 1 (see appendix i) was undertaken in May/June 1999 and was sent to twenty schools, in five counties across the South of England. Of the ninety questionnaires sent, thirty were received back (n=33%). Questionnaire 2 (see appendix iii), the main qualitative questionnaire of this research, was undertaken in

December 1999/January 2000. It was sent to eighty-two schools. Of the one hundred and sixty-nine questionnaires sent, sixty-one were received back (n=36%). Questionnaire 3 (see appendix v) was undertaken during October/November 2000, a year after the implementation of the National Numeracy Strategy and almost a term after the introduction of the Revised National Curriculum (DfEE/QCA 1999). Its dispersal was different to the other two questionnaires, being distributed by hand to forty-six participants (teachers, coordinators and head teachers) attending the final day of two of the five-day National Numeracy Strategy training courses. There was a further difference - questionnaire 3 was undertaken alongside discussions with the respondents in two separate groups, lasting approximately ninety minutes each. As this took place towards the end of the research, they provided an opportunity to address any outstanding questions. They also helped validate the conclusions. Being undertaken with the same teachers each supported the other.

In addition to answering the questions, many of the teachers added extra written contributions beyond what was asked. These were recorded across the top, sides, end, and on the back of the questionnaire sheets. Strength of feeling was also apparent through the use in all three questionnaires of underlined words or phrases, the use of CAPITAL LETTERS for certain words, the inclusion of one or more exclamation marks!!!, the use of more than one question mark??, as well as through words highlighted in "inverted commas". This was also apparent in the focus group discussions where some of the teachers sought me out during coffee or remained behind afterwards to raise further issues, ask questions or carry on the discussion further usually with regard to their own particular situation.

One further source of data came from a longitudinal study involving two teachers within the broader survey of opinion. Both of the teachers responded to questionnaire 1

and questionnaire 2, and chose to record their names on each. All teachers had the option to do so on questionnaire 1 if they were willing to answer a further questionnaire. Whilst most of the teachers did not, several did, but only two subsequently recorded their names on questionnaire 2. In so doing these two teachers allowed an assessment of the degree of change for each during the period from questionnaire 1 to questionnaire 2 (see 8.5 below) where I was able to assess their responses to each. An analysis identified if and where differences lay and why any such change in opinion or belief might have occurred.

Given the size of the sample and the limited geographical area of the research, conclusions were not expected to reflect the situation nationally nor be interpreted on a national scale. This is a small-scale research work, one seeking to explain from the responses of the teachers partaking how they conceptualise confidence. Notwithstanding, were the great majority of the teachers to reflect a particular view then it could provide indications of a possible trend, a possible basis upon which further future research might build (see Ch. 9 below).

e. The focus group discussions:

Data was also gathered from two focus group discussions (see Ch. 8 below), undertaken alongside questionnaire 3 on two separate occasions. Comprising forty-six teachers in total – including class teachers, mathematics coordinators and head teachers (twenty-five in the first group and twenty-one in the second group) - they sought to explore the teachers' views on aspects of the research and in so doing validate the conclusions. The focus group discussions also gave a picture of the situation with regard to confidence one-year on. Being undertaken by the same teachers who responded to questionnaire 3, they provided data in two different

formats and on two levels – publicly and privately. Discussions took place on the final day of two five-day National Numeracy Strategy training courses. Given this context it is likely that teacher awareness will have been raised to some degree. Although the discussions were not taped, key points were recorded in field note form.

As Wellington (1996) points out, focus groups can "enrich and complement both survey research, or a case study" (p.59). In the case of this study they enriched and complemented in a number of ways. First, they added greatly to the qualitative data already received and provided additional data at a later point in time. For example, with regard to the increase in teacher confidence they allowed a view as to whether the teachers believed with regard to their situation, that the increase was sustained, whether it continued to grow during the interim year or whether it declined once the initial input was over. Second, as a different group of teachers they provided support for conclusions already reached with other groups. For example, with regard to the general lack of confidence, the need to increase confidence, the benefits of certain types of training, the importance of confidence to teaching, to pupil attitude and learning, the fact that confidence affects how the teacher perceives herself as a teacher and the need for confidence to assist in the adoption of change into practice. Third, they allowed any outstanding questions or issues to be posed. For example, with regard to planning and the fact that the views of the teachers responding to questionnaire 2 were split concerning the need to plan in such detail - some found it useful whilst others reported that they found it a complete waste of time.

Wellington (1996) notes certain benefits that can arise from the use of focus groups. "The focus group sets up a situation where the synergy of the group, the

interaction of its members, can add to the depth or insight of either an interview or a survey." (p.59) This can occur as a result of group members stimulating each other into deeper fields of thought, sparking a response be it positive or negative, with the discussion moving on from there with a broader and deeper debate emerging as a result. Wellington (1996) points to further benefit, "focus groups can be a valuable tool, efficient for collecting data and sometimes giving insights in addition to one-to-one interviews." (p.63) It is most interesting that such was found to be the case in this research, where an issue was raised through the focus group discussion (see Ch. 8 & 9 below).

Verma and Mallick (1999) note three different forms of interview ranging from the very structured (where the interviewer uses a list of prepared questions without deviation), to the open-ended interview (where the interviewer works from more broadly defined objectives allowing a great deal of freedom in response). The focus group discussions adopted a semi-structured format, they followed on from a short paper given by the author who acted as moderator and presented the stimuli for discussion. The stimuli utilised a number of different forms. First, I chose to use a selection of data tables, displayed on the overhead projector and left open for comment and discussion. This data was taken from questionnaires 1 and 2, selected by the author on the basis of wanting to hear views and opinions on these particular questions so as to add additional insight – for example, one such concerned the reasons why the teachers acknowledged a lack of confidence in mathematics. Second, I chose particular questions arising from the data in order to obtain information one-year on – for example, with regard to the way in which the teachers believe confidence can be increased and that increase maintained. Third, I chose to outline certain of the emerging conclusions, looking for validation – for example,

certain of the recommendations set out in chapter 9. Discussions took place after each, some more protracted than others, and some centring on unexpected areas. Wellington (1996) notes certain advantages to the focus group format, not least the fact that it produces a great deal of data in a short period of time. It is also possible that those participating may progress personally as a result. This proved to be so, with some of the teachers reporting the support and confidence they gain from others, where a teacher discovers that she is not alone in holding a particular view, facing a certain problem or feeling a certain way. This actually proved to be an unexpected issue raised by the teachers in the focus group discussions and questionnaire 3 (see Ch. 8 below).

f. Reliability, validity and ethics:

Drawing up the questionnaires took a great deal of time and several factors were foremost in their construction so as to ensure reliability and validity (Evans 1984, Fink & Kosecoff 1985, Sommer & Sommer 1991, Nelson in Day et al ed 1993, Letiche in Day et al ed 1993, Ernest 1994, Youngman in Bennett et al ed 1994, Wellington 1996, Bell 1999). As Fink (1995) points out, "Unless the measures used to collect data are dependable, you cannot be sure that the findings are accurate" (p.58). The first factor concerned the purpose of the questionnaire, that the items provided the necessary information to answer the research questions but at the same time did not waste time asking unnecessary questions (Evans 1984). Second concerned the language, that it was clear, easily understood, consistent and unambiguous throughout (Wellington 1996 & 2000). Third concerned the range of options, given that all possible options could not be included in each question, were the options too narrow they would incur bias or slant (Bell 1999). Fourth concerned the questions, that they be without bias or

preference and interpreted as designed to be (Sommer & Sommer 1991, Nelson in Day et al ed 1993, Fink 1995, Bell 1999, Peterson 2000). Fifth concerned the length, as excessive length might deter teachers from replying – a problem associated with the questionnaire format as Entwistle and Nisbet (1976) and Evans (1984) point out. In this respect one question was omitted from questionnaire 2 - personal information on the respondent, (such as in questionnaire 1, question 17; and questionnaire 3, question 8). Although not necessary to the findings, it may have proven useful and interesting.

Wellington (1996) and Oppenheim (1996) note the importance of removing ambiguity or confusion. Each questionnaire was therefore piloted prior to final distribution. Piloting took place on a number of different levels, at different stages, with the questionnaires returning to the author for amendment after each. Sometimes feedback was written, sometimes oral, sometimes both. The pilot group covered different sectors, including teachers, subject coordinators, head teachers, researchers, retired teachers, academics and non-educationalists. As Oppenheim (1996) points out, piloting saves time. It also as Wellington (1996) notes, helps ensure that questions are clear and unambiguous, language is consistent, that a range of options are provided, that the questions are interpreted as intended and provide what is required.

As already seen (see 5.2b above) the written medium of questioning held several advantages for this particular research question. It allowed teachers to respond when and where suited them, without pressure from an interviewer or colleagues. It allowed freedom to voice opinion without intrusion, slant or expectation from the interviewer or colleagues. Being anonymous teachers were free to write without inhibition. All added to the credibility of the data and therefore its reliability (Schumann & Presser 1982,

Evans 1984, Sommer & Sommer 1991, Nelson in Day et al ed 1993, Letiche in Day et al ed 1993, Wellington 1996, Bell 1999, Peterson 2000).

Letiche (in Day et al ed 1993) notes a problem in adopting this format, where certain options are offered but in offering these options, others are automatically excluded. Given neither the time nor space to include all possible options in each question, this was addressed by including a broad spread covering the range of possible answers. Where the range was limited that was because the information required centred only on the options presented, for example, where the author required further confirmation of a trend noted in a previous questionnaire, or where numerical evidence was required on the particular options presented. To avoid author preference through certain inclusions and exclusions, teachers were encouraged to record their views and options within the "other_____" or "for example _____" spaces. According to Oppenheim (1996) this also adds to the reliability. Another method was to include two similar questions in the same questionnaire, most notably in the open-ended items of questionnaire 2. Again Oppenheim (1996) sees this as an important technique in ensuring reliability, as sets of questions "give more consistent results" (p.147). The conclusions are further strengthened by cross-referencing and through a comparison of responses, given that "the underlying attitude will be common to all the items" (p.147). In questionnaire 2 for example, three questions provided information on how the teachers believed confidence could be increased (see 8.3 below).

Letiche (in Day et al ed 1993) points to another possible danger inherent in the teacher research format, the fact that the investigation centres on the teachers' view of themselves. Certainly teacher responses are based upon personal experience, but that was the very benefit and basis upon which this particular research stood. Confidence is a personal issue concerning beliefs and attitudes. This research

therefore sought opinion on a personal issue from those who could best measure it, the teachers themselves. The fact that the Numeracy Task Force and government perceive something as being the case does not necessarily make it so. As such, whilst the Task Force note a lack of teacher confidence in mathematics, stressing the need to build-up confidence quickly (Numeracy Task Force 1998), there can be no guarantee that the teachers will agree with any or all of this statement. The question therefore in terms of this research concerned not who to ask, but how to obtain an open response from teachers on this question. Indeed, as will later be shown from questionnaire 2 the choice of anonymous questionnaire may actually have highlighted the fact that confidence generally speaking was perceived by the teachers to be higher than the level recorded by the same teachers for their own personal levels (see 8.2 below). This would suggest that the picture being presented by teachers generally speaking is more positive than that acknowledged on a personal level.

5.3 The analysis of the data.

a. The method of analysis:

In analyzing the data (see appendices ii, iv & vi) I sought to address the research questions by outlining the data, identifying general trends and more individualistic views, and highlighting similarities, differences, relationships and patterns. It was possible that unexpected issues might also arise. This research included mainly qualitative data but with a small amount of quantitative data also. With regard to qualitative data, Wellington (2000) notes six stages in the analysis process – immersion in the data; reflecting on it; analyzing, dividing up, selecting and categorizing; synthesizing; relating the data to other work; and reflecting back. Miles

and Huberman (1994) by comparison divide the analysis process into only three main stages – reducing the data; displaying it; drawing conclusions and verifying them. Notwithstanding, with regard to this particular research, the following four stages of analysis were adopted.

First, the data was sorted, ordered and displayed. Each questionnaire received a reference letter and number, consecutively in three batches (batch A for questionnaire 1, B for questionnaire 2, and C for questionnaire 3). This reference stayed with each quote at all times so that it was easily attributable and could be traced back quickly if required. Whilst the majority of the data was qualitative, there was a certain amount of quantitative data, arising for example from where teachers were asked whether they lacked confidence at a particular key stage, or whether they felt a lack of confidence existed generally speaking and why. For such questions it was sometimes possible to determine a numerical response from the qualitative data. Where possible this was tabulated on a spreadsheet according to the item, question-by-question, (see appendices ii, iv & vi). From this trends and strength of opinion with regard to these teachers could be assessed.

Sorting, reducing and arranging the qualitative data required a variety of categories, groupings and regroupings at various stages – dependent upon what was being sought. The groupings included, for example:

- Arranging responses according to the question they answer, item by item. For example, in question 2 the percentage of the teachers who believed that a lack of confidence existed generally was established by arranging responses according to a positive or negative response. However, ordering the same data according to the topic headings supplied by the teachers in their response – such as subject knowledge, their own experiences as a pupil, resources,

constant policy changes - showed why they believed it to be so and allowed the various reasons to be ordered.

- Arranging responses on the basis of highlighting all references to a particular topic. This allowed links and similarities made by the teachers in different questions to be identified. For example, with regard to subject knowledge (see 7.4 below), the National Numeracy Strategy training programme (see 6.2 below), the detailed planning format (see 8.4 below), and teacher attitude.
- Arranging responses within comparative groupings. Whilst this was also part of the analysis process through for example, comparing responses on confidence and subject knowledge at the different key stages (see Ch. 7 below) or on beliefs and values at two points pre and post strategy implementation (see 6.2 below), it also allowed comparison between the response of coordinators to that of class teachers on a particular question;
- Arranging responses so as to address all references on one particular question but where data was provided within more than one question. For example with regard to - What affects confidence (see 7.4 & 8.3 below)? How is confidence or a lack of confidence manifested (see 7.2 & 7.3 below)? How can confidence be increased (see 8.3 below)?
- Arranging responses so as to highlight any irregularities emerging. For example, the fact that teachers perceive their own level of confidence as lower than the level they perceive generally (see 8.2 below), or the fact that some teachers found the high level of planning to be a positive factor whilst others found it a negative factor (see 8.4 below).

- Arranged so as to display change over a period of time, in the small longitudinal study of two particular teachers who responded to both questionnaire 1 and questionnaire 2 (see 8.5 below), or through similar questions in different questionnaires but remembering that they came from two different groups of respondents (see 8.1 below).

Categories were generated and determined by the data and by the research questions, arising from what was being analysed and what was being sought. Topics were identified, grouped into categories, sorted according to themes or patterns, and conclusions reached. The categories therefore developed alongside the research. As Wellington (2000) points out, "The examination of the categories themselves is an activity of continuous refinement. Early categories are adapted, merged, subdivided or simply omitted: new categories are developed." (p.136)

One further factor in the analysis of data from this research, whilst there can be dangers in relying too much on preconceived ideas as Bell (1999) notes, there are also certain categories that are not difficult to foresee especially in light of the review of the literature. For example, with a programme of training being allocated within the National Numeracy Strategy, the means through which the government aimed to build up confidence, it was likely that training would be an issue raised by the teachers in some form or other (see 3.3 above & 6.2 below). Also, arising from the review of the literature it was clear that subject knowledge was likely to emerge as an issue somewhere in the teachers' responses to the questionnaires (Fresko & Ben-Chaim 1986, Numeracy Task Force 1998, Barrington & Harries 1999, Irwin & Britt in Jaworski et al ed 1999, OFSTED 2000, Stipek et al 2001) (see 4.3 above & 7.4 below). In addition, history and the review of the literature also highlighted the fact that the adoption of new ideas into practice could be an issue (Mathematical

Association 1955, Assessment of Performance Unit 1980, Cockcroft 1982, Manouchehri & Goodman 2000, Senger 1999) (see 4.6 above & 6.2 below). Furthermore, given the importance of the beliefs and values to which the teacher holds, highlighted in previous research findings (Thompson 1992, Askew et al 1997, Numeracy Task Force 1998a, Poulson et al 2001, Stipek et al 2001) and given that this research centred on what the teachers believe with regard to confidence, teacher beliefs were likely to be an issue from the outset (see 4.7 above & 6.2 below). The fact of these possibilities did not necessarily make them so, it did not predetermine a certain level or particular view, nor did it exclude other issues.

A cycle of analysis, undertaken at different levels with questions refined at each level, allowed more in-depth knowledge to be gleaned. For example, in explaining the teachers' understanding of what confidence is (questionnaire 2, question 6):

- Level 1 involved the formation of a list of factors from their responses – such as subject knowledge, planning, teacher attitude and experience. From this the number of teachers recording each factor could be determined, showing the most important factors and their order of significance.
- Level 2 involved looking at each factor separately – such as subject knowledge – to determine the degree of feeling, be it a lot or a little (for example in questionnaire 2, question 7 responses ranged through 'yes', 'a lot', 'very much', 'strongly', 'significantly', 'completely', or 'all the time').
- Level 3 took each of the main factors separately, it highlighted all references in other questions so as to analyse links or connections. For example, subject knowledge also emerged in answers to question 2 (on a

lack of confidence), question 8 (on improved practice) and question 11 (on increasing confidence).

b. Validation:

The third stage of data analysis in this work outlined the conclusions and recommendations arising. These were placed in context with regard to the existing knowledge and the literature, validated through questionnaire 3 and the focus group discussions. Given the danger of bias in assessing data, the evidence was documented alongside the conclusions in writing up, along with a selection of verbatim quotes from the teachers in support. Where great numbers of teachers responded in similar fashion, a selection of quotes was used rather than all of the quotes and was recorded as such – a few of the teachers, some, many, almost all of the teachers. Contrary arguments were also often presented to test the data. In addition, failings within the questionnaire itself were on occasion noted, most notably where information that may have proven useful, was not obtained.

One further aspect in the assessment of data was the longitudinal study across two questionnaires for two teachers within the broader area of research. All of the teachers were asked in questionnaire 1 on their willingness to respond to a second questionnaire. Several agreed, however, only two subsequently recorded their names on each of the two questionnaires. This presented a bonus to the research given that no guarantee could be there at the outset that any teacher would do so. In so doing these teachers allowed another dimension, a comparative analysis of their progress and the degree of any change that might have taken place during that period - in the context of what was required and provided by government, and based upon their responses to questionnaires 1 and 2 (see 8.5 below). By comparing the response of each teacher to each of the questionnaires, it allowed an exploration of the progress with regard to how

they perceived change within their practice; how they felt their confidence grew or not; their attitude towards mathematics, their teaching of it pre and post National Numeracy Strategy implementation; and how their beliefs and values altered, or not, over the period. Whilst providing only a small case study, it is nonetheless an interesting exercise, especially within the context of the before and after timing. In addition, it could provide an opportunity for follow-up research at a later date with regard to the confidence of these two teachers and their progress in the long-term. This is important given that as Verma and Mallick (1999) note, "the perceptions and experiences of the people making up the sample can change over time." (p.116)

Chapter 6: Expectations and attitudes towards the adoption of change into practice.

Chapter six reports the preliminary findings of this research in relation to the situation and context pertaining at the time of its commencement. It reports on views expressed in questionnaire 1 (see appendix ii) by thirty teachers, written at a point just prior to the implementation of the National Numeracy Strategy (see 5.2c above). It examines the expectations and attitude of the teachers responding to questionnaire 1 towards the strategy, outlining how they felt its adoption would affect their practice. Through an examination of these views, general patterns were identified within their responses, more individualistic attitudes and expectations were also highlighted. In addition, the range of responses helped determine topics and themes for follow up at a later point in this research.

The main data source for this chapter stems from questionnaire 1 (see 5.2c above). It provided mainly numerical data. This is summarised in this chapter in relation to the particular question from which it was obtained. The main data source for chapter seven stems from questionnaire 2 (see appendix iv). It provided mainly qualitative data. Reference is made to this data in this chapter where it provides additional information on the discussion in hand. The data from questionnaire 2 was obtained in written form from sixty-one teachers, one-term after National Numeracy Strategy implementation. This data is instrumental in explaining and demonstrating the views and opinions of these teachers with regard to confidence. As such and building on from the preliminary findings outlined in this chapter, chapter seven provides an account of teacher confidence, from the view of the teachers themselves, addressing several of the main research questions and explaining:

- what the teachers understand confidence to be;
- whether, and if so the degree to which, they believe confidence to be important to their practice;
- how they perceive confidence affecting that practice – in terms of how they feel about mathematics, how they teach, how they perceive their teaching, and pupil learning (see Ch. 7 below).

The main data source for chapter eight is questionnaire 2 and questionnaire 3 (see appendix vi). Chapter eight also draws on the two focus group discussions. Building on the findings outlined in chapters six and seven it reports the views of teachers one-year after National Numeracy Strategy implementation. Through the focus group discussions it also provides validation for the emerging conclusions.

This chapter is structured in two sections. The first section describes the expectations that the teachers responding to questionnaire 1 hold of the National Numeracy Strategy. It shows how they welcomed its introduction - despite the many curricular changes in recent years (see Ch. 2 above), the increased constriction it brought to their teaching (see Ch. 3 above), and an already heavy workload (National Association of Head Teachers 1999 & 2000). Indeed, no teacher felt that its implementation was not necessary. Nonetheless, regardless of the fact that the strategy set out not only what was to be taught but also how it was to be taught, promoting a particular philosophy of mathematics education, the majority of the teachers reported that they believed it would only change how they teach 'a little' rather than 'a lot'. The second section examines the preparations for implementation, what this demonstrated about the teachers' attitude and beliefs towards it, and the programme of in-service training allocated by government alongside. It shows how most of the teachers did not

expect their beliefs and values to change as a result of strategy implementation. It also shows limitations that they identify within the allocated training programme, where most felt it had adequately prepared them for National Numeracy Strategy implementation in 'some areas' rather than in 'all'.

6.1 Teacher expectations with regard to National Numeracy Strategy implementation.

With regard to the implementation of the National Numeracy Strategy, the teachers responding to questionnaire 1 in this study acknowledged that they believed the strategy to be necessary. This was visible in their responses to question 15, in which twenty-three of the thirty teachers (76.7%, n=30) felt that the strategy was necessary or essential, a further five (16.7%, n=30) believed it necessary but excessive, no teacher felt it was unnecessary (two teachers did not answer this item). This positive view is supported by a different group of teachers one-year later responding to questionnaire 3 (question 1) where forty-four of the forty-six teachers (95.7%, n=46) welcomed the strategy. The remaining two teachers failed to reply, explaining that they were newly qualified and so felt that they were not in a position to comment having not experienced the 'before' situation. All who responded therefore reported that they welcomed the strategy. This positive response is supported by the written views of teachers in questionnaire 2. Their comments suggest that they particularly liked, and gained benefit from, certain elements of the strategy – the "clear structure for progression", "clear teaching focus", the "examples of work/games", the "mental maths and whole class teaching", and the Framework itself "A good manual, easily understood". Many felt that the strategy provided support, gave greater security and improved practice, "By giving me more confidence". It provided uniformity, "There is

now an 'accepted' consensual view among staff on planning, recording and assessment. It is now much easier to track continuity and progression throughout the school" (discussed in greater detail at 8.3 below).

Despite the fact that they believe it to be necessary, however, and bearing in mind that it sets out not only what should be taught but how, fifteen of the thirty teachers (50%, n=30) (questionnaire 1, question 14) expected National Numeracy Strategy implementation to alter their practice only 'a little' and one expected it not to change at all. Fourteen (46.7%, n=30) expected it to change 'a lot'. With more than half of the teachers expecting implementation to change their practice a little or not at all then that raises questions for the future. It also recalls the implementation of previous initiatives already discussed (see Ch. 2 above). Given that the strategy is based upon and promotes one particular philosophy of mathematics education, requiring the adoption of certain teaching strategies and approaches, and outlining a certain structure (see 3.2 above), this could reflect a degree of naivety. One possibility is that it stems from a lack of knowledge on the part of some of these teachers regarding what is required, the degree of prescription and the likely effect on their teaching. Another possibility is that it reflects the level of change resulting from past initiatives, upon which these teachers are basing their response. Alternatively, it could reflect how deeply they hold to their existing beliefs and the level of unwillingness to change.

A comparison between how these teachers regard the strategy (questionnaire 1, question 15) and how they viewed previous initiatives (questionnaire 1, question 11) confirms the extent of the positive response to National Numeracy Strategy implementation. Whilst most (twenty-five, 83.3%, n=30) believed that curricular changes since 1989 had been necessary or essential, twenty-eight (93.3%, n=30) of

the same teachers believed that the strategy was necessary or essential. Of these teachers, nine (30%, n=30) believed that curricular changes since 1989 had been necessary but excessive by compared to five (16.7%, n=30) who believed that the strategy was necessary but excessive. Only one teacher believed that changes since 1989 had been unnecessary, none believed the strategy was unnecessary (two teachers did not reply to question 15, four did not reply to question 11). As such, despite the level of curricular reform in recent years (see Ch. 2 above) including upward of forty new curriculum documents since 1989, the teachers welcomed the National Numeracy Strategy and believed it to be necessary. More responded that they felt the strategy to be necessary than did the national curriculum, whilst fewer believed it to be necessary but excessive.

This is a positive response given that certain resentment of yet another change might have been expected (see Ch. 2 above). It would have been understandable were the introduction of the strategy seen as yet another initiative on top of many previous initiatives, and resented as a result. The fact of it being more constrictive could have added to that resentment, were teachers to see it as an infringement on their freedom to decide on approach, style and strategies, decisions they had previously been free to make (see Ch. 3 above). Also, as it outlines one particular way in which mathematics is to be taught this could have been seen as a criticism of past practice, on the basis that if the strategy is correct in its approach, then past practice in certain cases must have been incorrect – which could have had a negative effect on confidence. The fact therefore that the majority of the teachers welcomed the strategy as necessary is not only a positive response but also possibly even surprising.

From the data it is clear that whilst nineteen of the respondents (63.3%, n=30) were teaching pre-national curriculum, eleven of the thirty respondents (36.7%, n=30)

were not teaching prior to 1989. This could place a question mark over the validity of this comparison with national curriculum implementation. These teachers will, however, still have gained a perception of the general situation from their experiences as a pupil, from their time during teacher training, from classroom observation and teaching practice, from teaching and from conversations with colleagues. It cannot therefore be assumed that teachers who qualified post 1989 will have no concept of mathematics teaching, or of changes to the curriculum prior to that point. Indeed, their views – based upon what they have seen, been told, heard and read – could actually be more balanced given the broad spread of influences. What these teachers do lack, however, is the experience of actually addressing the associated administrative requirements at the time of each change - an experience that does not necessarily translate well in the telling and is probably best assessed by the doing.

Regardless, it is possible to separate those teaching prior to 1989 from those who were not, nineteen (63.3%, n=30) of the respondents had taught pre-national curriculum. Whilst almost all of the teachers (twenty-eight, 93.3%, n=30) felt that the National Numeracy Strategy was either necessary or essential, eighteen (94.7%, n=19) of those who were teaching prior to 1989 felt that curricular changes since 1989 were necessary or essential – reflecting very little difference. Where a difference does emerge is with regard to those who felt each to be necessary but excessive - five teachers (16.7%, n=30) felt the strategy to be necessary but excessive, by compared to nine (47.4%, n=19) of those teaching prior to 1989. As such, a larger proportion of the teachers reported that they found the national curriculum excessive than did the strategy, but why? As already seen, the National Numeracy Strategy carries greater constriction, adds to an already heavy workload, comes sandwiched between the National Literacy Strategy and the Revised National Curriculum (DfEE/QCA 1999),

and could be taken as a criticism of the way in which many teachers previously taught. Perhaps it was seen as bringing less change, which would tie in with the fact that, as already noted, more of these teachers believed that it would alter how they teach only a little.

There are a number of other factors that could account for the more positive response of these teachers to the strategy. First, the national curriculum was on its third redrafting in six years and from the author's experience teachers were becoming weary of the almost constant change. The job of 'teaching' carries with it essential administrative aspects that cannot be ignored, an administrative burden that is particularly time consuming during periods of curricular change, given the need to re-write associated paperwork at each review (Campbell & Neill 1990, Campbell et al 1991). In addition, OFSTED inspections continued throughout regardless of the upheaval, whilst the five-year period of stability recommended in Dearing (1994) appeared to have been ignored despite the fact that the government had accepted the report's recommendations in full. It is therefore quite understandable that teachers might see this as excessive. Second, whilst the national curriculum changed all subject curricula areas, the National Numeracy Strategy affected only one subject, making it more manageable as a result, despite coming on the heels of the National Literacy Strategy. Third, the success of the Literacy Strategy (National Association of Head Teachers 1999) and the similarity in format and structure of the National Numeracy Strategy could have influenced a more positive response and attitude in anticipation (National Association of Head Teachers 2000). Another possibility is that as questionnaire 1 was undertaken prior to strategy implementation, these teachers perceived it as bringing less change than might later be so. Clearly any or all of these may have been the case. There is, however, one further possibility supported by the

responses of different teachers in questionnaire 2 and already noted above – the teachers liked the strategy and acknowledged a personal benefit from certain aspects contained therein. They welcomed the greater constriction it brought, they liked the fact that there was a particular structure, a certain approach, laid down planning and content. Perhaps they felt more confident as a result, perhaps they saw this as guidance rather than constriction (see Ch. 8 below).

6.2 Teacher preparations for National Numeracy Strategy implementation.

a. Beliefs and values:

Despite promoting a particular philosophy of mathematics education, outlining what and how mathematics should be taught, thirty-two of the sixty-one teachers (52.5%, n=61) responding to questionnaire 2 (question 8) reported that their beliefs and values remained unchanged one-term after strategy implementation. Twenty-six (42.6%, n=61) felt that their beliefs had changed (one teacher did not respond to this item). All of the teachers said that they were adopting the strategy as part of their practice. This suggests two possibilities. Either the thirty-two teachers whose beliefs did not change were already following the same philosophy as promoted within the strategy and therefore had no need to change, or some were implementing the strategy whilst still holding firm to existing beliefs concerning mathematics teaching and learning. Evidence elsewhere shows that only ten of the sixty-one teachers (16.4%, n=61) were teaching in a pilot school where they had previously been implementing the National Numeracy Project, on which the National Numeracy Strategy was based and which therefore resembles it closely in content, approach and philosophy (see Ch. 3 above). Even allowing for the fact that these teachers were already adopting the strategy in all aspects, it is unlikely that all thirty-two were. One teacher offered an explanation

(questionnaire 2, question 1), "Time to plan and time to mark has meant old teaching styles used".

Before looking at the implications, there is one further factor. It concerns past initiatives and efforts to implement change into practice. As previously discussed, new ideas have not always been universally adopted by teachers in the classroom (see Ch. 2 above). Lessons can be learnt from past experiences, they can warn of things to come. With a history of past initiatives not being fully implemented, a question was included to this effect in questionnaire 1 (question 9), inquiring with regard to the introduction of the national curriculum and its effect on beliefs. Sixteen of the teachers (53.3%, n=30) believed that Mathematics in the National Curriculum had changed their beliefs and values 'a little', only two (6.7%, n=30) believed it had altered their beliefs 'a lot'. For six (20%, n=30) they had not changed at all (six teachers did not reply to this item). With regard to altering practice (questionnaire 1, question 10), thirteen of the same teachers (43.3%, n=30) said that implementing the national curriculum had altered their practice 'a little', five (16.7%, n=30) felt it had changed 'a lot', and six (20%, n=30) said that how they teach was unchanged (six teachers did not reply to this question). As such, although implementing a statutory document, albeit one that did not require implementation in a particular way nor the adoption of a certain philosophy of mathematics education, only two teachers (6.7%, n=30) believed that their beliefs concerning mathematics education had altered as a result of implementing the national curriculum. Five (16.7%, n=30) responded that how they teach had changed 'a lot'. The great majority acknowledged that it had caused a small change to their beliefs (sixteen teachers, 53.3%, n=30) and a small change to how they teach (thirteen teachers, 43.3%, n=30).

This ties in with the literature review where the question of teacher beliefs was discussed in detail (see 4.7 above). The integration of new beliefs does not occur quickly (Senger 1999). It is a complex process which when it does happen, happens over time (Poulson et al 2001). Pajares (1992) goes further suggesting that teacher beliefs remain almost unchanged over time. Teachers judge and teach the curriculum in light of what they already know and believe (Manouchehri & Goodman 2000), given a close relationship between the beliefs of the teacher and her practice (Kagan 1990, Thompson 1992, Ernest 1994, Fang 1996, Marino 1998, Senger 1999, Stipek et al 2001). Teacher beliefs have a powerful impact on the practice of teaching (Ernest 1994b, Senger 1999) and on pupil learning (Cobb et al 1993, Almeida & Ernest 1995, Middleton 1995, Manouchehri & Goodman 2000). They also affect what the teacher thinks of her own teaching (Fresko & Ben-Chaim 1986), her attitude and motivation, and the attitude and motivation of her pupils as a result (Irwin & Britt in Jaworski et al ed 1999, Ernest 1994). The holding of certain beliefs distinguished highly effective teachers from others (Askew et al 1997). Beliefs also affect what teachers learn from in-service training (Markovits & Even in Jaworski et al ed 1999). As such, the difficulty of holding to one philosophy whilst teaching to another is easy to see and could carry implications on several fundamental fronts.

It is interesting therefore that whilst twenty-six teachers (42.6%, n=61) felt their beliefs had changed as a result of implementing the strategy, more than half (thirty-two teachers, 52.5%, n=61) (questionnaire 2, question 8) acknowledged no change, despite the need to adopt a particular philosophy of mathematics education (one teacher did not respond to this item). As one teacher acknowledged (questionnaire 2, question 1), "Time to plan and time to mark has meant old teaching styles used". Having developed over time, the beliefs to which the teacher holds will have been

determined by how she herself was taught, by her knowledge and understanding of mathematics as a subject, and by her pedagogical beliefs concerning how pupils learn (see 4.7 above). Research has shown that the ability to change approach in teaching mathematics depends on those beliefs (Ernest 1994b, Fullan 1991, Poulson et al 2001). As Senger (1999) points out, however, "Many teachers' images and beliefs about mathematics and what learning mathematics entails may be incompatible with current research and reform efforts in the field." (p.200)

b. In-service training:

Most of the teachers (forty teachers, 65.6%, n=61) felt that National Numeracy Strategy training had been 'quite effective', rather than 'very effective' (eleven teachers, 18%, n=61), in increasing mathematical confidence - eight (13.1%, n=61) believed it was not effective at all (two teachers did not respond to this item) (questionnaire 2, question 12). The majority (thirty-four teachers, 55.7%, n=61) also believed that it had prepared them for implementation 'in some areas' rather than in all (eighteen teachers, 29.5%, n=61), whilst eight (13.1%, n=61) believed it had not adequately prepared them for implementation at all (one teacher did not respond to this item) (questionnaire 2, question 1c). Furthermore, whilst forty-one (67.2%, n=61) believed that confidence had increased as a result of training (questionnaire 2, question 9), most felt it had increased "a little" (thirty-five teachers, 57.4%, n=61) rather than 'a lot' (twenty-four teachers, 39.3%, n=61) (one teacher believed it had not increased at all, one did not respond to this item) (questionnaire 2, question 1). A few of the teachers in questionnaire 2 commented positively on the training, "All areas covered well". Some commented on high quality training within their own school, "Not enough training – luckily we have a very good coordinator", "We have

a leading maths teacher on the staff so the training has been excellent". The majority, however, referred to problems and limitations in the allocated three-day National Numeracy Strategy training package, "The training was not at all useful". These centred mainly on the timing, duration, content and delivery of that training (questionnaire 2, questions 3 & 14).

The majority of the teachers (questionnaire 2, questions 3 & 14) responded that "Generally training came too late", "Staff needed training before it was implemented and not alongside", "It would have been helpful if all the training was held in Summer 99 / Autumn 99 terms", "Would have been better to have had training – calculations – before September implementation", "All too rushed. Training should have occurred 18 months prior to launch", "Too close to September 1999, that is to say, training was in July 1999!" Several commented critically on the length of the training, "Too short a time: three days", "Not sufficient time to study the resources", "The training didn't allow time to plan and/or reflect on what needed to be taught", "Too concentrated", "Teachers need time to get familiar with the document and especially the progression". In addition, the delivery of the training was a disappointment for some, "NNS training lacked obvious confidence – the NNS staff did not appear convinced about what they were 'selling'", "We can all read, our training was the trainers reading out handouts", "Less playing of games – a demo would suffice", "Discussion from training has helped rather than training session".

Despite this, however, the teachers still identified in-service training as one of two key methods through which confidence could be increased. Indeed, they rated it second only to "personal dedication, time and effort" (questionnaire 2, question 12). As one teacher acknowledged, "I've learnt a lot from many courses I've been

on, but not everyone has had the same opportunity". In demonstrating this the majority of the teachers called for: "Training", "more training", "Further training", "Having further intensive training", "More courses", "A series of courses", "inset at our level", "extended study courses", "Frequent opportunity for training". This was supported by the response of teachers in the other questionnaires. For example, thirty-nine (84.8%, n=46) of the teachers in questionnaire 3 (question 7) called for training available "For all staff not just selected few", "You could always improve and training will always support this", "Learning should never stop", "Any extra training would be valued", "for the teachers who lack confidence in their ability".

The scale of the requested training was not small. The teachers reported the need, "For as many teachers as possible to undertake extended study courses such as Advanced Diplomas during which you have the time to focus on your teaching", "Frequent opportunity for training, INSET/twilight etc", "Regular, perhaps compulsory, courses to update teachers' own knowledge", "A series of courses to address my responses to question 6 (very good knowledge of the subject, methodology and an excellent understanding of the stages of progressions)" (questionnaire 2, question 11). Nor was the level of training confined, different forms of training could provide guidance and support in different areas. For example, colleagues could play a major part, "Further practical inspiration and ideas from practising teachers", "Observing lessons. Meeting with other coordinators", "Training is always useful to refresh and revisit ideas and strategies. Also good to share experiences with colleagues." (questionnaire 3, question 7)

In responding to questionnaire 2 the teachers identified areas in which they believed training was required, "The National Numeracy Strategy training did not cover any other areas of maths other than number. Maths is a huge subject!" They

noted the need for "More training on topics which teachers find difficult to teach e.g. proportion and ratio, percentages and decimals", "INSET in areas highlighted as staff weaknesses", "Support in other areas of mathematics eg. data and probability, shape", "ICT", "ideas for mental activities", "more lesson ideas/activities", "Shape & space, measures, data handling", "ideas for mental strategies". They also highlighted areas of personal need, "how to integrate children entering reception year at different times", "management of mixed age classes", "working with large classes for example thirty-nine with a large range of ability", "extension of year 6", "How to manage group work effectively while other children need help", "how to differentiate sufficiently within the framework of whole-class teaching", "problems of older children (yr 4-6) who haven't done yr 3 material", "support of special needs children with no extra help" (questionnaire 2, question 3). This could go some way towards explaining the apparent conflict – training is "very effective" in increasing teacher confidence in mathematics (questionnaire 2, question 12), but National Numeracy Strategy training "was not at all useful", increasing confidence "a little" rather than "a lot" (questionnaire 2, question 1).

Interestingly the teachers in questionnaire 3 undertaken one-year post strategy implementation reported similar areas of need, "Teaching problematic areas in maths", "Practical ideas – different methods of doing something", "Strategies", "How to teach the language of mathematics", "Highlighting differentiated activities to fit in main teaching session", "Ideas of how to approach topics", "Planning, differentiation within a year group – different key objectives", "assessment, planning etc", "Teaching strategies, observation, lesson planning", "Adapting the strategy to differing needs", "Actual tasks to try with children". Whilst problem solving was the most widely noted area of need reported by the teachers, other areas

included: "calculators", "Subject knowledge, mental/oral maths", "data handling", "Shape and space", "Shape, space, fractions, ratio, percentages etc and other specific areas of subject knowledge" (questionnaire 3, question 7).

The teachers in the focus group discussions stressed the importance of making training available to all teachers, not just for mathematics coordinators. They also emphasised the need for training at different levels – where a teacher who lacks confidence and feels insecure should not be placed within the same training group as a teacher who is confident. Both will have different needs, start from different points and are therefore unlikely to benefit from the same training. In support of this the OISE/UT (Earl et al 2003) external evaluation of the strategies acknowledged that, "Even with the Strategies' strong focus on building capacity, the magnitude of the task has meant that many teachers have had relatively little opportunity for the sustained professional development and consolidation that is needed" (p.6). The report further noted with regard to training and teacher capacity, "given the scale of the enterprise, it is not surprising that few teachers have experienced sustained and job-embedded learning. This, however, is the kind of learning necessary for large numbers of teachers to become competent and confident about new teaching approaches and content that may be fundamentally different from past practice." (p.91) The OFSTED (2002) report on the first three years of the strategy notes an improvement in knowledge and confidence, but with weaknesses still apparent. It too highlights the need for more five-day training courses as a matter of priority to improve teachers' subject knowledge. The report notes that the five-day training course has had a positive impact on the quality of teaching, "Many teachers have become more confident in teaching mathematics as a result." (OFSTED 2002, p.3)

The call for more training is perhaps only to be expected given the scale of the task and the fact that by 2002 whilst almost all schools had received direct training opportunities in at least some aspects of the strategy, for many teachers this involved training from their own mathematics coordinator - "many teachers have not had any direct input from anyone outside the school" (Earl et al 2003, p.41). But what if the school mathematics coordinator is not confident in mathematics, where she became coordinator through circumstances rather than through subject strength - which research has shown can and does happen (Webb 1993 & 1994)? The reality for the teachers in that school is not difficult to see. This could explain why some in this research report, "luckily we have a very good coordinator" and "We have a leading mathematics teacher on the staff so the training has been excellent". Others, however, report, "The training was not at all useful", "Discussion from training has helped rather than training session" and "We can all read, our training was the trainers reading out handouts. Why??" As one teacher observed, "The quality and professionalism of the mathematics manager is vital."

6.3 A summary of the findings.

Chapter 6 reports the preliminary findings of this research in relation to the situation and context pertaining at the time of its commencement. It examines the expectations and attitudes of the teachers towards the strategy, describing how they felt its adoption would affect their practice. Also, through a range of responses it highlights areas, themes or threads to follow up later in this research or even at a later date (see Ch. 9 below).

As successful reform of the syllabus or curriculum depends greatly on how willing the teachers are to accept and adopt the change, then what they expect, how

they perceive it affecting their practice and confidence, carries some importance. Teachers could have resented the National Numeracy Strategy bringing as it did greater constrictions, the introduction of yet more change, and an increase in what was already a heavy workload. It was, however, believed at the outset to be necessary or even essential by the vast majority of the teachers (questionnaire 1), no teacher felt the strategy was unnecessary. This was supported by the teachers in questionnaire 2 who reported benefit arising from particular aspects – "clear structure for progression", "structure of the lesson has heightened awareness of importance of mental/oral component", "more focused", "contains some useful ideas" and "mental maths and whole class teaching". (The nature of the benefit received by these teachers is considered in chapters 7 and 8 below, as is the effect of implementation on confidence.) This positive response also reflects on those teachers who may hold to different beliefs regarding mathematics teaching and learning. It demonstrates that they are open to the new requirements, they are positive in their view of what the strategy is and what it stands for, and might therefore be open to changing their beliefs as a result.

Despite the fact that the great majority believed it to be necessary, however, most of the teachers reported that their beliefs and values remained unchanged with regard to mathematics teaching and learning, "Time to plan and time to mark has meant old teaching styles used". The majority also expected National Numeracy Strategy implementation to change how they teach only a little. The discussion within this chapter gave rise to a number of questions. First, if altering practice by only a little, then how is that change manifested with regard to improved practice and in terms of addressing the Task Force focus of building-up confidence (see 8.3 below), given that the strategy outlines in detail what should be taught and how? One would expect it to have a significant impact on practice. Preliminary findings, however, suggest that these

teachers do not expect that to be the case (see 8.1 below). Also, assuming their "old teaching style" to be different to that promoted in the strategy, what of the teacher who holds to a different philosophy? Is she able to implement the strategy as it was designed and intended if teaching to one philosophy of mathematics education whilst holding to another? Research has shown that teacher beliefs are closely linked to practice (Ernest 1994, Senger 1999). It has also shown that teacher beliefs change slowly (Poulson et al 2001). These findings would suggest that for these teachers, much hinges on the level and success of the programme of training and support with regard to this question.

The allocated three-day National Numeracy Strategy training programme prepared teachers for implementation and addressed the Task Force focus of increasing confidence and competence (Numeracy Task Force 1998). Despite that, however, the majority of the teachers responded that they believed it had adequately prepared them in only some areas. Most pointed to shortcomings and limitations in the three-day package, centring mainly on timing, duration, content and delivery. With limitations of this nature, this calls into question the ability of this particular training package to address for these teachers the Numeracy Task Force focus, given that, as one teacher in questionnaire 2 points out, "Any new initiative 'undermines' confidence before growth happens". It also calls into question the likelihood of it altering to even the smallest degree the beliefs of teachers whose existing beliefs differ to that promoted.

In summary, through an examination of the views certain general patterns were identified within the response of the teachers. Most believed the National Numeracy Strategy to be necessary and welcomed it. The majority did not, however, expect it to greatly alter their beliefs and values concerning mathematics education, nor

did they expect it to greatly change how they teach mathematics in the classroom. As such, having outlined the context from which confidence was expected to grow, having explored confidence through the literature, and building on from the preliminary findings outlined in this chapter, chapter seven addresses confidence - what do the teachers in this research understand it to be; how important is it to their practice; and how do they perceive it affecting that practice.

Chapter 7: Teachers' understanding of confidence.

The purpose of this chapter is to report the findings in relation to how the teachers in this research perceive confidence. The main source of data for this chapter is the open-ended items of questionnaire 2, although it does also draw on some data from questionnaire 1 (see Ch. 6 above). Chapter seven reports the views of sixty-one teachers given in written form in questionnaire 2, one-term post National Numeracy Strategy implementation at the end of December 1999/January 2000. An examination of their views allows me to identify how they conceptualise confidence. The range of responses provides a fuller picture, allowing general patterns and more individualistic attitudes to be identified. Building on from the preliminary findings outlined in chapter six, this chapter explores what the teachers understand confidence to be, how important it is to their practice, how they perceive confidence affecting that practice, and the link which they draw between confidence and competence.

This chapter is structured in six sections. The first section describes how the teachers believe confidence affects practice, described through their own words recorded in response to the open-ended items in questionnaire 2. It identifies the two main ways in which they see their practice affected – through teaching competence and pupil confidence. Sections two and three report on how the teachers define confidence and a lack of confidence. In so doing it identifies the two main areas on which they believe confidence is centred – secure subject knowledge and sound teaching – with a positive attitude identified as a third area alongside. With regard to a lack of confidence, it reports that the teachers attribute it mainly to a lack of subject knowledge (discussed in section four) and to their own experiences as a pupil (discussed in section five). Finally, in section six I examine the link between

confidence and competence, demonstrated through the teachers' perceptions of how confidence affects practice and in their understanding of what confidence is.

7.1 How confidence affects practice.

The teachers in their response to question 7 (questionnaire 2) acknowledge that confidence affects practice: "all the time", "a lot", "very much", "strongly!", "greatly", "significantly", "completely". An analysis of responses to the open-ended items concerning how they feel confidence affects practice, allows all but three of the sixty-one responses to be classified under two headings:

- teaching competence – affecting basic aspects of teaching such as the pace, rigour, focus and purpose of the lesson; also affecting opportunities for learning and therefore pupil achievement as a result (see 7.6 below);
- pupil confidence – where the teachers' lack of confidence rubs off on the pupils, influencing as a result their attitude, enjoyment, confidence and achievement in mathematics.

With regard to the effect of teacher confidence on pupil confidence, the teachers responding to questionnaire 2 believe that a confident teacher "changes [the] effectiveness of pupil learning". She "enhances pupils opportunities", "can enthuse the pupils with a sense of excitement, wonder and an 'I can do this' attitude", "is more relaxed, enjoys teaching and the children respond". Teacher confidence "builds confidence in pupils". Pupils sense the teacher's confidence, "Children are aware of teachers' confidence", "If you are not confident I believe it passes onto the children", they "can often tell how confident a teacher is", they "quickly pick up vibes – a confident teacher probably exudes an excitement about the subject". Teacher

confidence "shows in the confidence of the children" affecting attitude and achievement. Pupils become "more confident, increased attainment", "If teachers are confident the lesson becomes more enjoyable, varied and interactive". One teacher summed up the general feeling "Confidence is essential and has [a] bearing on [the] confidence of children and outcomes". The teachers are very clear in emphasising the importance of confidence for competent teaching and pupil confidence. They highlight factors without which it would be difficult not only to teach confidently but competently (see 7.2 & 7.6 below), "The more confident, the better the practice". In setting down how they believe confidence affects their practice, they have noted the importance of confidence to how they teach, how they feel about their teaching, how pupils learn, the ability of pupils to have-a-go, their attitude and confidence in mathematics – all key areas in effective teaching and learning (see 7.2 below).

7.2 What is confident teaching?

In their response to question 6 (questionnaire 2) the teachers report confident teaching to be mainly concerned with two factors:

- secure subject knowledge - "it helps to have good subject knowledge or to feel that you as a teacher are confident with the logical thinking that mathematics requires" (see 7.4 below);
- sound teaching, incorporating a variety of strategies and teaching approaches, good classroom organisation, and addressing particular class and individual needs - "good subject knowledge delivered in a variety of ways to stimulate children".

One further element noted in the response of many of the teachers but usually referred to in conjunction with secure subject knowledge and/or sound teaching, is a positive enthusiastic attitude.

With regard to sound teaching the teachers (questionnaire 2, question 6) believe it results from, and is manifested in, a variety of teaching approaches and strategies, appropriate to the task in hand and to the level of the pupils. It involved having "Knowledge of children and what is appropriate to their needs", "knowing where children have come from mathematically, where they are now and where you want them to be". To that end it entailed "Using skills already learnt to increase children's understanding, building on concepts". The teachers believed that confidence enabled them "to use a variety of teaching strategies to engage all children". It involved classroom management and lesson organisation, including planning, addressing laid down objectives, and demonstrating "good classroom skills", "a confident teacher is well prepared with planned activities", "able to plan effectively". Confidence is also the ability "to introduce new ideas and styles with confidence and flair", a willingness "to try out new methods".

With regard to a positive attitude, the same teachers believed that confidence involves teacher enjoyment and enthusiasm, "Confidence re-knowledge of subject, teaching and assessing effectively. Also an enjoyment of teaching maths". They perceived a confident teacher as one who demonstrates "enthusiasm for the subject", "an enjoyment of teaching mathematics". She is "energetic, enthusiastic, exploring and discussing different methods". She "probably exudes an excitement about the subject". This positive enthusiastic attitude has a positive enthusiastic effect on the class, it "rubs off on pupils", "If you are confident you give more enthusiasm to the children and a willingness to learn", you can "motivate and sustain children's enthusiasm for

mathematics". As a result the teachers note evidence of "pupils increased enjoyment", children who are "active, proactive and enjoying what they are doing". The importance of a positive attitude incorporating enthusiasm, excitement and enjoyment – reflected in and arising from teacher confidence - was widely noted in response to several other questions also. As one teacher noted, "Confidence = enthusiasm = knowledge = gain". This gain could be interpreted as gain for the teacher resulting from greater knowledge. It could also apply to the pupil, gain through increased knowledge and achievement.

The teachers report therefore that they believe confidence is concerned with secure subject knowledge and sound teaching, wrapped in a positive enthusiastic attitude. Enjoyment, enthusiasm and excitement are all practical reflections of a positive teacher attitude, reflecting how the teacher feels about the subject and her teaching of it. But would they be present without confidence? They are certainly unlikely to be present where fear, insecurity or weakness exists (see Ch. 4 above), given that as these teachers point out, a positive attitude reflects certain confidence, a degree of ease and security. There are several interesting points arising in this respect. The teachers emphasise the importance of what they know and how they use that knowledge in the classroom – as one would expect. By including attitude in their definition of confidence, however, they are also emphasizing the importance of how they feel about the subject and their teaching of it. The literature review (see Ch. 4 above) and the preliminary findings (see Ch. 6 above) have already shown that the feelings and attitude of the teacher – be they positive or negative – directly affect teaching and the ability to adopt new ideas into practice. A positive attitude rubs off on pupils affecting their attitude, achievement and sense of enjoyment as a result. Furthermore, if confidence is "the ability to introduce new ideas and styles with

confidence and flair", a willingness "to try out new methods", and it is shown that the teachers in this research believe a lack of confidence exists (see 8.1 & 8.2 below), then this could go some way towards explaining why good advice has not always in the past been adopted in the classroom (see Ch. 2 & Ch. 4 above).

7.3 How is a lack of confidence manifested?

If confidence "affects the whole lesson(s), your enjoyment therefore children's enjoyment" and "teacher confidence rubs off on the children – confident teachers will produce good lessons", then what of the teacher who lacks mathematical confidence? As well as defining confidence through subject knowledge, the teachers also identified subject knowledge in terms of what they see as a general lack of confidence (questionnaire 2, question 2). In responding to questionnaire 2 the teachers attributed a lack of confidence to two main factors:

- the teachers' own experiences as a pupil (see 7.5 below):
- a lack of secure subject knowledge - "Lack of personal subject knowledge", "many do not have a strong mathematical background", "Lack of secure grasp of mathematics oneself", "many teachers struggled with maths themselves", "Usually due to feeling a 'failure' themselves in this subject area", "Our own subject knowledge and ability in maths" (see 7.4 below).

A number of other factors were also noted by several of the teachers in questionnaire 2, sometimes alongside one or other of the above, but to a lesser degree. They included: the number of curricular changes in recent years; the need for more training (see 6.2 above); a general lack of time in schools; and the need for additional support.

The need for curricular stability: "A period of stability, where teachers know there will be no more changes for the foreseeable future". Several of the teachers pointed to "the quantity of changes in the National Curriculum that we have had to cope with this has, in the past, undermined morale and confidence". They reported the need for a period of stability, to allow strategies and changes to practice to become established. This would also allow resources to be gathered and give confidence time to grow, "Too many changes implemented too quickly", "Too many changes without thorough research and resting. Commonsense is needed". Furthermore, it would also allow consolidation of practice, "Years of changing the curriculum every few months and having no time to consolidate or reflect". Some of the teachers felt quite strongly on this issue, "Leave us alone to get on with it for a few years!", "Teachers are feeling overloaded by so many changes in the curriculum".

The need for more time: "The training didn't allow time to plan and/or reflect on what needed to be taught. We have given time towards this but it's meant doing about twice the amount of maths work (training/planning)." Quite a sizeable number of the teachers pointed to the need for time on a number of fronts. First, time to address practical everyday aspects of effective practice, "The time and effort making resources for each child to have fan cards, number cards, arrow cards etc". Second, time to plan and evaluate, "time to discuss and plan", "hours of planning", "sharing/ discussing the planning". Third, time to observe good practice, to share ideas and discuss with colleagues, "Watching quality teaching and learning in practice", "Witness 'model' teachers", "More time to look at training videos, lesson observation", "More opportunities to share good practice", "Discussion from

training has helped rather than training session", "Confidence has increased enormously mainly as result of discussions across school", "share ideas on activities and how they went. Encouragement to try out activities and share how they went (good/bad aspects)", "TIME – to discuss not just what to teach but how to teach it (in year groups)". As one teacher pointed out, "I have visited local schools to watch numeracy hours in action. By talking to staff this has been the most helpful".

The need for greater support: "More help with activities", "Need to produce material to support framework, further examples, documents, worksheets, etc", "Working with leading mathematics teachers and coordinators (planning, teaching, evaluation)". In some cases the teachers asked for support to address a particular need arising from the strategy, "Ideas for activities related to objectives", "Ideas for mental strategies". Some referred to a need arising from their own particular situation, "More examples, materials for use to support framework. Including extension activities for more able year 6", "SEN". Others, however, referred to a general mathematical need, highlighted perhaps as a result of the strategy but not necessarily arising from it, "More examples of good practice", "Sharing ideas/practice – what does/doesn't work", "Lesson ideas, activities, a whole variety of methods", "A good ideas book for starting lessons", "Schemes of work/activities – these act as a starting point which can be extended/adapted to fit specific needs". As one teacher noted, "Support from colleagues for example, share ideas on activities and how they went. Encouragement to try out activities and share how they went (good/bad aspects) Being more open lets everyone see that no one has all the answers – less confident teachers appreciate this." (This issue was also raised by the

teachers in the focus group discussions and is therefore discussed in greater detail in Ch. 8 below.)

There were two issues arising from this data. First, the fact that teacher confidence could be expected to vary from subject to subject reflecting individual strengths and weaknesses. That being so it is possible that the situation for mathematics might prove no better or no worse than for any of the other core subjects. Unfortunately I did not ask the level of confidence for other subject areas in questionnaire 2. (In questionnaire 1 (question 16) it was found not to be the case, where only eleven (36.7%, n=30) felt most confident in mathematics prior to National Numeracy Strategy implementation, fourteen (46.7%, n=30) felt most confident in science, and twenty-seven (90%, n=30) in English. However, as this inquired of a different group of teachers, similar findings cannot be assumed.) Second, with regard to the three main reasons identified by the teachers for a lack of confidence in mathematics, it is interesting that neither of the two main reasons, subject knowledge and their personal experiences as a pupil, resulted directly from the strategy itself (questionnaire 2, question 2). They may have been highlighted by strategy implementation but do not arise directly from it. As such they were likely to already be present and given the historical context from which the strategy emerged (see Ch. 2 above), probably date back many years. For example, the problem with regard to subject knowledge was highlighted in several reports over the years (Mathematical Association 1955, Cockcroft 1982, OFSTED 1997). The problem with regard to the teachers experiences in school – in terms of the mathematics they were taught and how – was also addressed through the introduction of several new initiatives during the course of the twentieth century (see Ch. 2 above). The fact that they remain an issue, highlighted by the teachers in this

research, is interesting and important in itself. It is also a pointer for the future, the fact that the mathematical confidence of tomorrow's mathematicians is being shaped today. Yet it is being shaped by teachers forty-five (73.8%, n=61) of whom believe a lack of confidence exists amongst teachers with regard to mathematics and its teaching (questionnaire 2, question 2).

7.4 Subject knowledge and confident teaching.

The teachers (questionnaire 2, question 6) defined confident teaching in terms of secure connected subject knowledge and good teaching strategies: "Confidence comes with subject knowledge", "Good subject knowledge delivered in a variety of ways to stimulate children", " Knowing the subject and being able to teach it and present it in an interesting and exciting way", "Being sure of the subject and having the imagination to develop confidence and achievement", "Good basic knowledge of the subject, enthusiasm, knowing where children have come from mathematically, where they are now and where you want them to be – therefore how to get them there!". With regard to secure subject knowledge as one teacher reported, "It helps to have good subject knowledge or to feel that you as a teacher are confident with the logical thinking that maths requires". Indeed, a large proportion saw confident teaching as being synonymous with subject knowledge, at least in part, "Excellent subject knowledge", "sound knowledge of subject and progression of skills", "teacher is secure in own knowledge", "good background knowledge of maths", "g̲o̲o̲d subject knowledge", "very good knowledge of the subject", "teacher who has good subject knowledge", "secure subject knowledge", "good basic knowledge of the subject", "confidence re-knowledge of subject", "secure knowledge of the subject".

In their responses (questionnaire 2, questions 2, 6 & 7) the teachers gave examples of particular benefits to their practice arising from secure subject knowledge. These included the ability to move more easily around the subject, "Teachers able to move beyond their planned lessons and able to adapt/revise spontaneously as required". It included the ability to handle unexpected problems or diversions, "Not concerned if a lesson takes a slightly different turn than you had planned for", "Being able to cope with unexpected questions or diversions". It included the ability to demonstrate the connectedness of mathematics, "Confident teaching in mathematics is when the teacher has a secure knowledge of the subject and is able to make links across different areas of mathematics". They reported that it helps develop a broader picture of what mathematics is, "The teacher thoroughly understands the subject matter and how this fits into the 'bigger' picture".

Overall a cross analysis of responses to all three questionnaires as well as the focus group discussions demonstrated that the teachers in this research perceive good subject knowledge as providing:

- confident movement within the subject - freeing the teacher to concentrate on pupil learning and instruction;
- security of knowledge - allowing the teacher to move securely across and through the subject, identifying learning opportunities and maximising them;
- depth of understanding - providing a breadth and depth of knowledge beyond the minimum required, where connections can be made between the various aspects of mathematics and greater understanding achieved as a result, and where the teacher can apply and use her knowledge in a variety of different contexts;

- mathematical thinking - allowing the teacher to think, work and teach in a mathematical way;
- positive attitude - developing an appreciation of the subject in its own right, its power and strength, an attitude passed on to and picked up by pupils.

Acknowledged by the teachers as the most important element in developing confident teaching in mathematics, forty-nine (80.3%, n=61) of the teachers in questionnaire 2 rated subject knowledge "very important" for increasing teacher confidence one-term post strategy training and implementation (questionnaire 2, question 4). Although not possible to compare given that each stems from a different sample, and also bearing in mind that both samples are small, it is interesting that in questionnaire 1, undertaken pre-strategy implementation, only twenty teachers (66.7%, n=30) felt that subject knowledge was "very important" for developing confidence and competence in mathematics (questionnaire 1, question 5). Although arising from two different groups of teachers, the difference is interesting. Why should subject knowledge appear to have increased within a one-term period, covering the implementation of the strategy? In what respect might teacher awareness have been heightened? Did strategy training and implementation draw attention to the importance of secure connected subject knowledge in the teaching and learning of mathematics, a necessary element for the confident and competent implementation of the strategy? Did it draw attention to a lack of subject knowledge and the importance of having knowledge to implement the strategy? Or did the need to address new content, a new approach and perhaps even a whole new philosophy of mathematics education, simply highlight the fact that secure connected subject knowledge is not only necessary for competent and confident teaching but can also help when implementing change into

practice as it removes one major area of worry, gives greater security and the ability to move around the subject with ease (see Ch. 4 above)? The longitudinal study of two teachers, Teacher A and Teacher B, proves interesting in this respect (see 8.5 below).

One further factor emerging from the analysis of the data in questionnaire 2 (questions 2, 6, 7, 11 & 13) is that several of the teachers added a qualification to their answer. They differentiated, sometimes with regard to certain topics, but more usually between the different key stages, where they felt confident at one but less so, or not at all, at another. Generally speaking where such qualification was made a lack of confidence was felt to be "Not a problem at KS1 generally", however, "we are an infant school – we feel confident – but doubt we would cope if transferred to the next key stage", "speaking to other teachers some have expressed feelings such as I am glad I haven't got year 6, I couldn't do it!" The teachers made mention of subject knowledge security and the abstract difficulty of mathematics at the higher levels, "at the higher end of the school – own knowledge of the subject". This was reported in several questions in all three questionnaires. For example, in questionnaire 2 (question 10) only twenty of the teachers (32.8%, n=61) felt completely confident from reception to year 7, whilst thirty of the teachers (49.2%, n=61) felt mostly confident but only at certain key stages. Analysing this further, more of the teachers felt confident at KS1 than at KS2 or year 7 - not entirely unexpected at year 7 but clearly of some concern at KS2. In questionnaire 3 (question 5) thirty-four of the teachers (73.9%, n=46) felt completely confident at KS1, however, this dropped to twenty-five (54.3%, n=46) at KS2 and ten (21.7%, n=46) at year 7 (one teacher did not respond to this item at KS1 and KS2, two did not respond at year 7). In some cases the differentiation could perhaps be partly attributed to the fact that the teacher taught in an Infant or First School and had

therefore hardly any exposure to other levels. In several cases, however, the teacher herself added comments to specifically refer to the difficulty of the subject at a higher level and to her own degree of security or insecurity at a particular level. Furthermore, certain strength of emotion was present in several of the responses, where the teacher chose to underline particular words, to use capital letters or use exclamation marks – "NO!!"

The response of the teachers would suggest that many do not feel confident across the entire primary range. They report limits regarding confidence – perfectly confident at one key stage or in one class but not equally so at another. As one teacher in questionnaire 3 commented, completely confident at "year 3". The concept of limited confidence carries implications for a system where the movement of teachers across classes for a variety of reasons is not unusual – perhaps in line with promotion, the particular needs of the school or moving area. It suggests the possibility of specialisation, not generally seen at primary level, but in this case specialisation according to age range or key stage rather than subject. Arising from a variety of possible reasons – perhaps the length of time spent teaching that age, teacher training, increased knowledge, personal preference or experience – the teacher has become more confident in teaching one particular class or key stage. Indeed, the author is aware of many teachers who have over the years remained within one key stage, unwilling to stray far from that age. It would perhaps be an interesting exercise to establish why – whether due to training, preference, knowledge, circumstances, experience, security, confidence or a combination. Or whether indeed it is none of these and another reason exists entirely. This also raises a question with regard to the percentage of teachers who are confident at one level

but who would loose some or even all of that confidence if transferred to another class or key stage.

7.5 The teachers' experiences as a pupil.

Whilst nine teachers (14.8%, n=61) believe that teachers do not lack confidence in mathematics, the majority forty-five teachers (73.8%, n=61) report a lack. A further three (4.9%, n=61) believe it does not exist at KS1 (questionnaire 2, question 2) (four teachers did not respond to this item). As already seen, they attribute it mainly to insecure subject knowledge (see 7.4 above) and to the way in which they themselves were taught, "My own insecurities stem from my perception that maths is difficult, my lack of knowledge/confidence and how I was taught", "The way the teachers were taught themselves", "I attribute it mostly to teachers experiences when they were pupils", "Poor maths teaching when they themselves were pupils". It is reported to be a problem arising from a "Lack of personal attainment", "Minimum qualification". Some of the teachers felt able to identify a particular approach or style, "The way teachers have been taught maths themselves – probably completely algorithmic", "I would attribute this to poor maths teaching when they were at school – taught tricks not understanding", "Our training has shown how much influence the bad teaching in the 70's/80's has affected the confidence of otherwise good teachers." They believed that as a result, "many teachers struggled with maths themselves", they "Lack a secure grasp of mathematics", and admit to "feeling a 'failure' themselves in this subject area".

Teacher training was not believed to have greatly helped either, according to responses in questionnaire 1 (question 7) where the majority rated their own mathematics training "poor" in the areas of subject knowledge, teaching approaches,

class management and pupil assessment (rather than 'quite good' or 'very good'). Indeed, no area was rated "very good" by the majority. With upward of ten subjects to address – covering not only curricular content but also subject knowledge, teaching approaches and strategies, classroom organisation, planning, assessment, discipline and other organisational aspects – the time for each cannot be great. This, however, must present a very real problem for the student entering training with a lower level of subject knowledge in mathematics (see 4.2 above). It could also go some way towards explaining why the Third Annual Report (Chief Inspector for Schools 1993) notes of teachers, "most were still not confident mathematically" (p.29).

In pointing to their own experiences as a pupil the teachers raise a question with regard to what is currently happening in classrooms across the country, given that the mathematics teaching of today will impact on the confidence and competence of tomorrow's teachers. The implications, however, go deeper. As one teacher pointed out, "Those teachers who found it easy during their own schooling appear the most confident during INSET." This is interesting as it supports the literature, where confidence helped teachers to take on-board new ideas during in-service training (Irwin & Britt in Jaworski et al 1999). The teacher who lacked confidence was found to regress rather than progress during the course of the training (see 4.3 above). Fresko and Ben-Chaim (1986) also linked an increase in confidence with in-service training, at least in the short-term (see 4.3 above).

7.6 Competence and confidence.

All of the teachers believed that confidence and competence were linked – indeed the majority, twenty-four of the teachers (80%, n=30), believed that they were linked a lot,

whilst six (20%, n=30) believed they were linked a little, no teacher believed they were not connected (questionnaire 1, question 3). The link between confidence and competence is further supported by the responses of different teachers in questionnaire 2 (question 7) who report on the various ways in which they perceive this link, "The more confident, the better the practice", "confident teachers teach well", whilst a teacher who lacks confidence is "afraid to take risks, experiment, allow children to explore". Almost all felt that "confidence gives better practice" and is "at the core of planning and implementing effective lessons". The teachers believed it to impact from the most fundamental aspects of practice upwards, for example "rigour and pace", "If you are confident you know where you are going and what you want to achieve. If you are not, you rely on published resources that might not really push the children in the correct direction/speed", "If the teachers are confident the lesson becomes more enjoyable, varied and interactive", "makes it much more focused and purposeful". It was felt that a confident teacher "usually has well planned 'pacy' lessons", her teaching is "much more focused and purposeful", she "can tackle any situation that arises effectively, for example, dealing with misunderstandings". Having confidence allows her "the time and space to develop imaginative teaching. Provides pace and progression", "confidence = good +". The majority of the teachers reported that confidence affects practice "all the time", "essential", "greatly", "completely", "very much", "a lot", "significantly", "Strongly!"

Examining the different key stages, the majority of the teachers felt completely confident in all aspects of the curriculum at KS1, but not at KS2 where confidence levels halved (Questionnaire 1, question 1) – twenty-four (80%, n=30) of the teachers felt completely confident at KS1, twelve (40%, n=30) at KS2, and five (16.7%, n=30) at year 7. When asked separately on their levels of competence, a

similar picture emerged. Again most felt 'completely competent' at KS1, this declined at KS2 and again at year 7 (Questionnaire 1, question 2) – twenty-five (83.3%, n=30) of the teachers felt completely competent at KS1, fourteen (46.7%, n=30) at KS2, and three (10%, n=30) at year 7. At the top end of the scale where teachers felt completely confident and levels were therefore high, the link between confidence and competence is close and visible as such at each key stage (completely confident = KS1 (24 teachers, 80%), KS2 (12 teachers, 40%), year 7 (5 teachers, 16.7%); completely competent = KS1 (25 teachers, 83.3%), KS2 (14 teachers, 46.7%), year 7 (3 teachers, 10%) (n=30). There is parallel movement in very close proportion throughout, even where the decline is steep.

At the other end of the scale where teachers acknowledge having hardly any confidence a similar relationship emerged with regard to those who expressed little confidence and competence. Again it was demonstrated at each of the key stages and with regard to movement across the different key stages. Only one teacher (3.3%, n=30) acknowledged having hardly any confidence at KS1, this rose to two teachers (6.7%, n=30) at KS2, and ten teachers (33.3%, n=30) at year 7 (Questionnaire 1, question 1). When asked about competence separately, a similar picture emerged. No teacher felt that she had hardly any competence at KS1, two teachers (6.7%, n=30) acknowledged hardly any competence at KS2, with nine teachers (30%, n=30) believing they had hardly any competence at year 7 (Questionnaire 1, question 2). At the bottom end of the scale therefore where confidence levels are reported to be low, the link between confidence and competence is again visible at each key stage. Again there is parallel movement in reasonably close proportion throughout.

The significant decline in what the teachers perceive their confidence and their competence levels to be between KS1 and KS2 is somewhat disturbing but also

interesting. The fact that more teachers feel confident and competent at KS1 than at KS2, where the level of required subject knowledge is more difficult, is not surprising. This also ties in with the research findings of Barrington and Harries (1999) who found similar conclusions with regard to PGCE student teachers (see Ch. 4 above). The decline in confidence and competence levels at year 7 is also unsurprising given that most teachers do not train to teach year 7 and few have experience of middle schools where year 7 classes are present. What is surprising is the decline between KS1 and KS2, where levels almost halved. It was possible that the higher levels at KS1 could have been caused by a greater number of KS1 teachers in the sample, but that was not the case. The distribution of teachers responding to these items shows no leaning towards KS1. (Twenty-three (76.7%, n=30) were experienced KS2 teachers, twenty-two (73,3%, n=30) experienced KS1 teachers and ten (33.3%, n=30) had taught year 7). This is considered later in this work in light of additional evidence.

Confidence was separated from competence in asking these questions so that individual levels could be obtained, allowing comparisons. Were any correlation to be shown it could then be determined across the different key stages. This also allowed for an assessment of movement, with regard to direction and proportion, emerging. In making that comparison the close link between expressed levels of confidence and expressed levels of competence is interesting as it shows a maximum difference of three teachers (n=30) at any one point. This also allows for a very small degree of exception. Furthermore, where movement occurs - and even where that movement is dramatic, such as between KS1 and KS2 - the relationship between expressed confidence levels and competence levels is maintained, in parallel upward and/or downward direction. The degree of decline between KS1 and KS2 reflects a decline as the level of abstract mathematical difficulty increases. This also ties in with the

connection made by the teachers in questionnaire 2 between subject knowledge and confidence (see 7.3 above).

Although the Task Force acknowledged the importance of the relationship in its focus, there could be no guarantee that the teachers in this research would acknowledge a similar or even close link with regard to their own practice. Despite the fact the no teacher in questionnaire 1 believed confidence and competence were not linked, and despite the strength of belief apparent from different teachers in their written responses to questionnaire 2, it is of course possible that a confident teacher may feel that she is more effective than she actually is because of her high level of confidence. Similarly, could not a teacher who is highly effective perhaps see herself as being less so because she lacks confidence? There are two possibilities here. Either levels of correlation and interdependence between confidence and competence are exaggerated and generally speaking there is a slim link. Or the link is actually very strong and it is the exception not to see great correlation. On the basis of the teachers responding in this research, and bearing in mind that this is a very small-scale largely qualitative research project and as such neither designed nor aimed to draw conclusions on a general level, the relationship between confidence and competence is clearly apparent.

7.7 *A summary of the findings.*

Chapter 7 reports the findings from mostly qualitative data and a small amount of quantitative data, gathered mainly from questionnaire 2, which was undertaken one-term after National Numeracy Strategy implementation. It examines the beliefs and understandings of sixty-one teachers with regard to confidence. In addressing several of the main research questions laid down at the outset of this work (see Ch. 5 above), it describes what the teachers understand confidence to be, how they believe

confidence affects practice, how they see confidence manifested in practice, and to what they attribute a lack of confidence. Through a range of responses it pinpoints the two main areas upon which these teachers believe confidence, and a lack of confidence, to centre. It also inquires as to whether they believe a link exists between confidence and competence.

The teachers report that they believe confidence is "essential", affecting practice "all the time", "completely". Confidence affects competence – affecting basic aspects of teaching such as the pace, rigour, focus and purpose of the lesson. It also affects pupil confidence – where the teachers' lack of confidence rubs off on the pupils, influencing as a result their attitude, enjoyment and confidence and achievement in mathematics. If confidence "affects the whole lesson(s), your enjoyment therefore children's enjoyment" and "Teacher confidence rubs off on the children – confident teachers will produce good lessons", then lacking mathematical confidence causes a major problem in both respects. The teachers attributed a lack of confidence to insufficient subject knowledge and to the teachers' own experiences as a pupil. This suggests a problem of long standing but also one with current implications. The fact that the teachers date this problem back to their own experiences at school, and therefore back some time, is in itself worrying. It suggests that it will be neither easy nor quick to overcome, despite the Task Force focus noting the need to build up confidence quickly.

The teachers report that they believe confident teaching is concerned with secure subject knowledge and sound teaching. This incorporates a variety of strategies and teaching approaches, good classroom organisation, planning and addressing particular class and individual needs - "good subject knowledge delivered in a variety of ways to stimulate children". Many also include a positive enthusiastic attitude as a

factor alongside. By including attitude in their definition the teachers are emphasizing not only the importance of what teachers know and how they use that knowledge, but also how they themselves feel about the subject. Research has shown the importance of the teacher's attitude to the attitude of the pupil, and the importance of the pupil's attitude to the level of his achievement in mathematics (see Ch. 4 above).

The teachers report particular benefit to their practice arising from secure connected subject knowledge. It allows them to move more easily around the subject, "Teachers able to move beyond their planned lessons and able to adapt/ revise spontaneously as required". It gives them greater ability to handle unexpected problems or diversions, "Being able to cope with unexpected questions or diversions". The teacher must also demonstrate knowledge of the connectedness of mathematics. As two of the teachers point out, "Confident teaching in mathematics is when the teacher has a secure knowledge of the subject and is able to make links across different areas of mathematics" and "The teacher thoroughly understands the subject matter and how this fits into the 'bigger' picture". Emphasising the importance of the teacher being secure in her subject knowledge is not new (Cockcroft 1982, OFSTED 1997, Numeracy Task Force 1998). Concerns over levels of teacher subject knowledge are also not new (OFSTED 2000, OFSTED 2000a, Earl et al 2000a). It is interesting therefore that given the implementation of a new strategy for teaching mathematics, its programme of training, the Task Force focus, and a history of concerns with regard to subject knowledge, that the OISE/UT (Earl et al 2003) external evaluation of the strategies notes considerable disparity in teacher subject knowledge and pedagogical skill, with gaps or weaknesses visible in subject knowledge and pedagogical understanding. The OFSTED (2002) review of

the first three years of the numeracy strategy supports this reporting, "Many teachers have improved their knowledge and confidence in teaching mathematics. There are still weaknesses, however, which restrict their ability to help pupils to overcome their difficulties and improve their understanding. The strategy rightly has given priority to providing more five-day courses to improve teachers' subject knowledge." (p.2)

The teachers report that they believe that confidence and competence are linked 'a lot' rather than 'a little'. None of the teachers in questionnaire 1 (n=30) or questionnaire 2 (n=61) believe they are not linked. Measured separately, levels of confidence and levels of competence show a maximum difference of three teachers (n=30) at any one point. Where movement occurs and even where that movement is dramatic, such as between KS1 and KS2 where the number of teachers feeling completely confident halved from twenty-four to twelve (n=30), the relationship is maintained. On that basis and for these teachers, confidence is unlikely to be present without competence. This is upheld in the literature, where effective teachers are optimistic about their ability and are shown to demonstrate confidence in most situations (Hay McBer 2000) (see 4.5 above).

Several of the teachers differentiated between confidence at the different key stages, where for some confidence was "Not a problem at KS1 generally", however, "we are an infant school – we feel confident – but doubt we would cope if transferred to the next key stage". Almost half, thirty teachers (49.2%, n=61), felt mostly confident but qualified this confidence to only at certain key stages. This clearly creates a problem should these teachers be moved to a class in which they feel less confident or in which they have hardly any confidence. Teacher movement from class to class or across the key stages is not unusual at primary level, where

traditionally teachers are expected to teach all subjects with a confident competence to all classes. On the basis of this sample, however, movement for some of these teachers could result in a major loss of confidence in mathematics.

In summary, the teachers in all three questionnaires report that confidence is very important. They believe it is concerned with key aspects of effective teaching and learning - secure subject knowledge and sound teaching. It is also concerned with a positive enthusiastic attitude. In defining confidence the teachers are drawing attention to what they know, how they use that knowledge and how they themselves feel about the subject and their teaching of it. They attribute a lack of confidence mainly to insufficient subject knowledge and to their own experiences as a pupil – neither of which results directly from the strategy itself having been present beforehand. As such, they are issues of long-standing and therefore unlikely to be speedily resolved. The teachers noted several other factors to a lesser degree, such as a lack of time, the number of curricular changes in recent years, and the need for greater support in a number of areas. Several of the teachers emphasise in particular the importance of secure connected subject knowledge, the fact that it allows them to move more easily around the subject, to handle unexpected problems or diversions, to demonstrate the connectedness of mathematics, and to develop a broader picture of what mathematics is. The teachers believe that confidence and competence are linked 'a lot' rather than 'a little'. No teacher believed they were not linked. Some differentiated between their levels of confidence at the different key stages, almost half felt mostly confident but only at certain key stages. They believe that teacher confidence affects teaching competence, teacher attitude, pupil confidence, pupil attitude and achievement in mathematics. In so doing they confirm

the conclusions reached in the literature review, that confidence is an important factor in the teaching and learning of mathematics.

Chapter 8: Confidence, post National Numeracy Strategy training and implementation.

This chapter reports on the situation with regard to confidence post National Numeracy Strategy training and implementation. It reports the views of teachers expressed in questionnaire 2 (to which sixty-one teachers responded) and questionnaire 3 (to which forty-six teachers responded) on the impact of the National Numeracy Strategy on teacher confidence, given the Task Force and government focus (Numeracy Task Force 1998). These views were expressed one-term (in the case of questionnaire 2) and one-year (in the case of questionnaire 3) after National Numeracy Strategy implementation. This chapter also reports on views expressed during the two focus group discussions (involving twenty-five teachers in the first discussion and twenty-one in the second).

The main data sources for this chapter are questionnaire 2 and questionnaire 3 (see Ch. 5 above). Questionnaire 2 (see appendix iii) provided qualitative data in written form, questionnaire 3 (see appendix v) provided numerical data and some qualitative data again in written form. One further source of data stemmed from a longitudinal study of two teachers in the broader field of research who responded to both questionnaire 1 (pre National Numeracy Strategy implementation) and questionnaire 2 (one-term post strategy implementation), thereby allowing an examination of their development over that particular period as reflected in their responses to each questionnaire. The findings from this data were validated through the two focus group discussions (see Ch. 5 above), which were undertaken alongside questionnaire 3, one year after strategy implementation.

This chapter is structured in six sections. The first section reports on how the teachers perceive confidence generally speaking, post strategy training and implementation. The second section describes how the same teachers describe their own personal confidence. Responses revealed that the teachers rated the increase of personal levels substantially lower than the level they perceived to exist generally. Section three inquires into how the teachers feel the National Numeracy Strategy has impacted on confident practice. It shows that whilst they acknowledge that confidence levels have increased, the majority still believe a lack of confidence exists. It also shows that the teachers gained greater benefit from strategy implementation than from strategy training. Responses suggest that this arises from limitations within the allocated training, and benefits they identify emerging from implementation. The fourth section examines an area in which there was some disagreement amongst the teachers - detailed planning. Whilst some of the teachers found the detail required useful, others felt it was excessive, a waste of time and simply adding to their already heavy workload. The fifth section reports a longitudinal study of two teachers, examining their development with regard to confidence through their responses to questionnaire 1 and questionnaire 2. Finally section six validates the findings by way of the two focus group discussions and questionnaire 3.

8.1 Teacher confidence – generally speaking.

Almost all of the teachers responding to questionnaire 2 reported that they believed confidence had increased as a result of the strategy (questions 1 & 9). As one teacher commented, "I think teacher confidence has improved as a result of the National Numeracy Strategy, but in the past confidence was generally low" (questionnaire 2,

question 2). Despite that, the majority (forty-eight, 78.7%, n=61) still perceived a lack of confidence generally (questionnaire 2, question 2). Three of the teachers (4.9%, n=61) qualified their answer to exclude KS1, nine (14.8%, n=61) reported that they believed there was no lack, whilst four phrased their response in such a way as to make it difficult to equate a clear 'yes' or 'no' (as an open ended item no options were offered). One-year post implementation this was further supported by a different group of teachers (questionnaire 3, question 2), the majority of whom (thirty-five, 76.1%, n=46) reported what they perceive as a lack of confidence generally (nine (19.6%, n=46) felt there was no lack and two did not respond to this item).

With regard to particular key stages, the teachers responding to questionnaire 3 (question 5) felt more confident at KS1 (thirty-four teachers, 73.9%, n=46) than at KS2 (twenty-five teachers, 54.3%, n=46) or year 7 (ten teachers, 21.7%, n=46). The decline in confidence as the key stages rise supports earlier findings in questionnaire 1, one-term pre-strategy implementation, where twenty-two teachers (73.3%, n=30) felt completely confident at KS1, twelve (40%, n=30) at KS2 and five (16.7%, n=30) at year 7 (question 1). As this involves two different groups of teachers it is not possible to draw comparisons between the two questionnaires, nor as already noted (see Ch. 5 above) to draw general conclusions given the small samples involved, however, one can wonder why levels were not higher in questionnaire 3. Given that as one teacher pointed out, "Any new initiative 'undermines' confidence before growth happens" one might have expected more teachers to feel confident on a number of counts. First, questionnaire 3 was undertaken one year after strategy implementation and therefore offered time to adjust to and become more familiar with, the new requirements – as one teacher pointed out, "Teachers need time to get

familiar with the document and especially the progression". Second, resources would have been prepared at that point, thereby lessening the workload, "The time and effort making resources for each child to have fan cards, number cards, arrow cards, etc", "having good resources is what has really increased confidence". Third, there were quite a sizeable percentage of subject coordinators responding to questionnaire 3 by compared to questionnaire 1 (questionnaire 3 had twenty, 43.5%, n=46) (questionnaire 1 had eight, 26.7%, n=30). Finally, most of the respondents to questionnaire 3 had just completed the five-day training course and rated it highly, acknowledging great personal benefit arising, "five-day course very valuable – should be offered to all staff – difference over five days = huge" (see 8.6 below).

8.2 Teacher confidence - personally.

When asked on their own personal levels of confidence (questionnaire 3, question 9), as distinct to teacher confidence generally (questionnaire 3, question 1), and the effect of strategy training on that confidence, the picture presented by the same teachers was somewhat different. Almost all of the teachers reported that they believed confidence had increased generally as a result of strategy training, however, less than half of the same teachers felt that their own confidence in teaching mathematics to their class - not even to all classes - had improved as a result of the same training. Forty-one (67.2%, n=61) reported that strategy training had increased their confidence in teaching mathematics to their class. Of that forty-one, however, ten (16.4%, n=61) qualified their answer to 'a little'. (Fifteen (24.6%, n=61) reported that it hadn't, one teacher felt it was questionable and four did not respond to this item). The discrepancy between the fifty-nine teachers (96.7%, n=61) who believed that confidence improved generally (questionnaire 2, question 1) and the forty-one (67.2%, n=61) of the same teachers who

reported an improvement in their own personal confidence resulting from the same training (questionnaire 2, question 9) reflects an interesting degree of difference.

In reporting on what they perceive generally, the teachers based their response on what they perceive from the picture presented to them by fellow colleagues. This will have been assessed through for example, formal and informal conversations in school, during meetings and while attending courses. The message appears to be one of teachers growing in mathematical confidence and it is a message received by almost all of the teachers (fifty-nine, n=61) (questionnaire 2, question 1). The difference between this, however, and what the same teachers report personally would appear to reflect the degree of false confidence being demonstrated by teachers in public - to colleagues, on courses and in the staff room. As one teacher noted, "Children don't miss a trick therefore some teachers must fake confidence at times!" It would appear that this could apply not only to in the classroom but also within the staff room.

But why should the teachers feel it necessary to present a more confident picture publicly? Could it be because of the importance of confidence to mathematics teaching and learning - the teachers in this research noted its importance to how they teach and to pupil learning (see Ch. 7 above), it is also one of two key factors highlighted by the Numeracy Task Force and government. Alternatively perhaps it is because of the importance of confidence to the teacher herself, to how she feels about mathematics and her teaching of it, given that the same teachers acknowledge the effect of confidence on how they perceive their teaching (see Ch. 7 above). Whilst faking confidence - "Children don't miss a trick therefore some teachers must fake confidence at times!" - is certainly one option, it is an option with questionable benefit given that the underlying problem remains

unattended, perhaps even unnoticed if the teacher is a good actress and carries the act out of the classroom.

There is one further possibility as to why some teachers might feel the need to fake their levels of confidence, they do not want to appear lesser or inadequate in front of colleagues who themselves appear confident - what if they are the only ones who lack confidence? As one teacher reported with regard to the focus group discussions, "Interesting to find out from the results of the survey where other teachers worries/interests lie, and how alike the thinking in the teaching profession is". Another noted, "Interesting and reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often! That's the teaching profession!!" These were not isolated comments. As an issue of some importance arising from this research, they are discussed in greater detail at 8.6 below.

The call for help, support and guidance was widely recorded in a number of areas. One teacher commented, "I didn't enjoy mathematics before! Working on that one now!" She further added, "I can teach it but not always understand it. I'm ready to accept new ideas". By "new ideas", however, does she mean more subject knowledge, a different and perhaps easier approach, or does she just search for answers to what she does not know – seeking help, security, guidance, support and greater confidence? The teachers identified a number of ways in which they could receive this – such as observing examples of good practice, "More time to look at training videos, lesson observation – time to discuss and plan"; through discussion "By talking to staff this has been the most helpful"; through the sharing of good ideas "More opportunities to share good practice". The need to share good ideas was highlighted in several questions in questionnaire 2 (questions 1, 3, 8, 11 & 12), as

well as by the teachers in questionnaire 3 and the focus group discussions (see 8.6 below). The OISE/UT (Earl et al 2003) external evaluation of the strategies also notes the benefit from support by effective teachers to those lacking confidence and competence, where one or two effective teachers can "through discussion and modeling, expand the awareness and expertise of colleagues" (p.109) Yet the report mentions that most of the teachers felt that it was not easy to talk to colleagues because of the physical lay-out of the school, most felt they did not build on each other's strengths within the school, hardly any had worked with teachers from other schools on plans or programs, and most felt that detailed classroom guidance was needed.

8.3 The impact of the strategy on confident teaching.

Almost all of the teachers in this study (questionnaire 2, question 13 & questionnaire 3, question 3) reported that they believed that the National Numeracy Strategy had improved teaching effectiveness generally – improved their confidence and competence in teaching mathematics. Of the fifty-nine (96.7%, n=61) teachers who acknowledged improvement to their practice, twenty-six (42.6%, n=61) reported that it had improved a lot, nineteen (31.1%, n=61) that it had improved a little, and fourteen (23%, n=61) that it had improved in some aspects (two teachers were newly qualified and so did not respond to this item) (questionnaire 2, question 13). No teacher felt that teaching effectiveness had not improved to some degree.

Responding on a personal level rather than generally, again the majority (fifty-two, 85.2%, n=61) reported an improvement to their practice (five teachers felt that it had not improved and two did not respond to this item) (questionnaire 2, question 8).

The strategy encompassed two aspects from which teacher confidence and competence could grow – the programme of training, and implementation of the strategy itself. These were separated for inquiry in this work. According to twenty-nine (47.5%, n=61) of the teachers confidence increased 'a lot' as a result of strategy implementation, twenty-six (42.6%, n=61) believed it increased 'a little', (five teachers felt that it had not increased and one did not respond to this item). With regard to strategy training, twenty-four (39.3%, n=61) believed that training had increased confidence 'a lot' but thirty-five (57.4%, n=61) felt it had increased by only 'a little' (one teacher felt it had not increased at all and one did not respond to this item). As such, whilst the teachers reported that confidence had increased, they believed that implementation was more effective than training in so doing (although training was greatly valued in other respects, see 6.2b above).

The positive comments of the teachers suggest that they liked and gained benefit from certain areas of the strategy:

- the structure and approach – "Clear structure for progression", "Structured approach laid out", "More confident with the structure of the lesson", "Structure has been useful", Structure of the lesson is clearer", "The lesson is more structured and the planning is in place", "More confident with the structure of the lesson",.
- the focus and progression - "Much more focus", "Clear teaching focus is good", "A far more focused approach to teaching each lesson", "More focused/rigour", "More focused, more time for mathematics", "Pace and focus of lesson", "More precise learning objectives", Lessons have more specific focus", "More focused – use more ideas/resources", "More focus on what is to be learned", "More focused teaching. More consistency and

continuity", "Better prepared, clearer learning objectives", "Focused planning objectives", "It has focused especially on content", "Lessons are more focused and the children have specific targets to reach".

Whilst the majority made reference to these areas, other areas were also noted, for example, "Getting children to interact in whole class sessions. Teaching maths rather than letting children 'discover' maths", "Concentrating on understanding before recording", "Children do, talk more, write and 'practise' less", "Greater expectation of all pupils", "More 'whole' class teaching and use of plenary", "having good resources". Several noted an improvement in their own subject knowledge arising from the strategy, "Better subject knowledge and more varied strategies used", "Clearly understanding the step", "developing lots of strategies". The mental/oral work was also believed by a sizeable number of the teachers to be helpful, "Structure of the lesson has heightened awareness of importance of mental/oral component", "Good mental strategies", "Oral work/questioning – involves whole class, allows differentiation", "Focus on acquiring mathematics facts". Some welcomed the uniformity and progression, "There is now an 'accepted' consensual view among the staff on planning, recording and assessment", "It is now much easier to track continuity and progression throughout the school", "Teachers who were less confident in progression found strategy helped", "I can see progression far more clearly so I can meet the needs of the above and below average child".

The teachers also reported positive comments on the Framework itself. As one said, the strategy "provides a clear structure to lesson, provides objectives for setting goals, continuity and sequence within year and from year to year, provides

assessment opportunities". It also provided content ("A good manual, easily understood"); ideas ("it's helpful and contains some useful ideas"); structure ("structure has been useful"); approach and strategies ("Excellent philosophy problem solving based"); organisation, planning and evaluation ("planning left to schools – we all re-invented the wheel"). It therefore left little unattended, outlining most of the practical aspects required for day-to-day teaching in the classroom. As one teacher emphasised, "it is so prescriptive – you cannot go wrong!" In so doing, however, it also addressed the main areas which the teachers identified as very important to confident and competent teaching – subject knowledge (forty-nine teachers, 80.3%, n=61), lesson ideas and activities (forty-seven teachers, 77%, n=61), planning and evaluating practice (forty-eight teachers, 78.7%, n=61), class management and organisation (forty-three teachers, 70.5%, n=61) (questionnaire 2, question 4). A further benefit was the fact that the teacher could read the Framework at her leisure, referring back to it when necessary, without the pressure that can be faced in front of others when on training courses (as in the case of 'Emily' discussed at 4.3 above (Irwin & Britt in Jaworski et al ed 1999)).

Comments by different teachers in questionnaire 3, recorded one-year later, were of a similar nature. It was possible, however, to separate these responses into two groups – those made by subject coordinators and those by class teachers - for further analysis. The respondents included twenty coordinators (43.4%, n=61) and twenty-four class teachers (52.2%, n=61) (two head teachers also responded):

Coordinators - "I liked the whole class approach to teaching maths topics and giving a tighter syllabus to follow: also training in using resources," "Provides a clear structure to lesson, provides objectives for setting goals, continuity and sequence within year and from year to year - provides assessment opportunity",

"Structure and focus; that all aspects were to be covered during each half term", "Focused teaching and strategy", "It gave me the knowledge to assess the key objectives", "Steps in progression. Guidance for each year group. Planning different aspects of maths into the year", "Definite progression shown", "It clarifies expectations and defines what is to be taught", "Structured scheme, more continuity and progression", "I felt I needed the direction and structure to ensure I was meeting and extending the children's learning", "It gave a balanced structure to teaching – valuable guidance", "More focus – ideas for each stage of development".

Class teachers - "Liked the structure of what to teach, when to teach it and plenty of ideas of how to teach it", "Provided a structure and an aid to planning", "More mental maths was needed – back to basics", "Highlights the importance of teaching", "Structure for all levels of planning", "It provides structure and support. Tells you what to do, when to do it, how long etc", "It was necessary to have a document across all schools offering progression and consistency. Also important to have examples of what to teach and a heavy emphasis on mental strategies", "It has built up confidence in maths and structured my teaching", "More focus", "Focused approach", "Very structured clear and helpful during QTS training", "Very structured, clear guidelines", "Focuses me – structure, examples are there for me to expand upon", "Structured", "To give clear guidance. Show progression. Ideas/support /planning", "Structured programme of what to teach when", "Structure, increase sub knowledge at primary level", "Ensures better organisation so all areas covered", "Offered structure, progression, guidance", "It is so prescriptive – you cannot go wrong!", "Structure, continuity and progression

across KS1/2", "Structured programme – knew all areas covered and to what level and levels above and below year group".

Whilst the class teachers appeared to look to their own particular practice, the coordinators tended to take a whole school view, not entirely unexpected. Noticeably each group gained benefit from the focus, the structure and approach, being almost universally acknowledged. Many class teachers, however, also noted benefit arising from the examples and ideas they received through the training and outlined in the Framework. They welcomed the "guidance" and "support" in terms of what and how they were teaching.

Despite this improvement, however, one term post strategy implementation, nine (14.8%, n=61) of the teachers reported that they did not feel completely confident teaching all aspects of the curriculum to all classes, reception to year 7. Twenty (32.8%, n=61) reported that they did but of this twenty, fifteen (24.6%, n=61) said that they had already felt confident prior to the strategy (questionnaire 2, question 10). Furthermore, of the thirty-three (54.1%, n=61) who reported feeling mostly confident, thirty (49.2%, n=61) were not confident not at certain key stages, with the other three not confident in certain topic areas. As such, most of the teachers (forty-two, n=61) believed that they were not completely confident in all aspects of mathematics outlined in the statutory curriculum. In addition, most who qualified their answer limited their confidence to certain classes or key stages. Several who reported that they were not confident 'at all' responded by writing NO in large capitals, by underlining the NO several times, or by following it with a number of exclamation marks. The message was made very clear.

One-year post strategy implementation a different group of teachers reported a very similar situation. Over half of the teachers (twenty-six, 56.5%, n=46) felt they

still needed greater confidence with regard to their subject knowledge, twenty-five (54.3%, n=46) reported that they needed greater confidence in implementing the strategy, and twenty-seven (58.7%, n=46) that they needed greater confidence in implementing the Revised National Curriculum (DfEE/QCA 1999) (questionnaire 3, question 6). This is despite the fact that the respondents had just completed the five-day training course and despite the fact that almost half (twenty respondents, 43.4%, n=46) were mathematics coordinators (questionnaire 3, question 8).

There are a number of factors arising from this data. First, the need to increase confidence in subject knowledge is consistent with and further confirms the findings already emerging from questionnaires 1 and 2 (see Ch. 7 above). All three questionnaires therefore demonstrate the same conclusions in this respect – which are also consistent with the literature (see 4.3 above). The reported need for greater confidence in implementing the curriculum is somewhat surprising, given that the Revised National Curriculum (DfEE/QCA 1999) was drawn up alongside the strategy and it had been in place for more than a year at this point. The teachers therefore had more than one year in which to become familiar with the required content, structure, approach and philosophy. It is possible of course that some may have been referring to the subject knowledge contained within the curriculum rather than the curriculum itself. They could also have been referring to the philosophy underpinning, where their beliefs differed to those laid-down within the curriculum.

The second factor arising concerns the fact that so many report a lack of confidence one-year on (questionnaire 3, questions 2 & 5). This is expressed despite the government focus, the allocated training programme, and despite having just undertaken the five-day training course. Furthermore, whilst they report an increase in confidence (questionnaire 3, questions 2), the majority also still believe that they

need greater confidence in subject knowledge, the strategy and curriculum (questionnaire 3, question 6). This suggests the possibility of a larger scale problem than was perceived at the outset and reflected in the three-day training package, designed and allocated by the government to address the problem perceived. It also suggests that confidence may not be quick or easy to increase. This is supported by the fact that the teachers report major rather than minor factors behind their lack of confidence - subject knowledge ("Lack of personal subject knowledge") and teaching ("Lack of understanding of the fundamentals and how to get these across to children in a way that they can understand") (questionnaire 2, question 2). It is further supported by the fact that the teachers attribute a lack of confidence to insecure subject knowledge ("Lack of secure grasp of mathematics oneself") and their own experiences in school ("The way the teachers were taught themselves and not understanding mathematics") (questionnaire 2, question 2).

A third aspect arising concerns the structure. Whilst noted by many of the teachers as one of the most beneficial factors arising from the National Numeracy Strategy, this proved not to be the case for one teacher, "I don't like the structure of the numeracy lesson. Why do we have to do a mental/oral starter in every lesson? I find the mental/oral starter is only successful if it links to the main lesson. I find it difficult to cope with teaching more than one objective in a lesson. Some teachers/ pupils find mental calculations threatening – why can't we write it down!" The depth of feeling is quite apparent - "I find it difficult to cope". The choice of words such as "threatening" suggests fear, based upon perhaps a lack of security and confidence in the subject – "Some teachers/pupils find mental calculations threatening". Furthermore, she may not be alone in feeling as she does. One teacher (questionnaire 2) when asked whether she felt a lack of confidence existed

generally, acknowledged, "Not confidence, confusion, despondency, lack of clarity in past as to what government wanted. Too many changes without thorough research and testing. Common sense is needed." Another noted the need for, "Support from colleagues for example, share ideas on activities and how they went. Encouragement to try out activities and share how they went (good/bad aspects) Being more open lets everyone see that no one has all the answers – less confident teachers appreciate this." Another noted the need to "fake confidence at times!" Others reported, "I didn't enjoy maths before! Working on that one now!" and "My own insecurities stem from my perception that maths is difficult, my lack of knowledge/confidence". The insecurity is not difficult to see. As one teacher comments, a lack of confidence is "Usually due to feeling a 'failure' themselves in this subject area". It would appear that some "teachers need continuous input/help to improve their practice".

8.4 An area of disagreement - detailed planning.

In responding to this research the majority of the teachers were generally in agreement with regard to the issues raised. The question of detailed planning, however, proved to be an exception to this, with two very different and almost opposite stances being adopted. The majority of the teachers (forty-eight, 78.7%, n=61) agreed that planning is 'very important' for developing and increasing teacher confidence in mathematics. A further ten (16.4%, n=61) felt that it was quite important (two teachers felt it was not important and one did not respond to this item) (questionnaire 2, question 4). Where opinions greatly differed, however, was on the degree of planning necessary, the level of detail.

Some of the teachers benefited from having to plan in great detail, allowing them to identify and focus their lesson objectives and teaching more clearly as a result,

"Specific planning helps focus teaching", "focused planning objectives". These teachers noted an increase in their own levels of confidence and competence as a result. Indeed, some pointed to ways in which their planning could be further assisted and improved, "More time to plan", "Help with organizing the medium-term plan, that is to say, teaching to the number of days as suggested". Some even asked for further training in this particular area, "Day training with all staff looking at medium term plans to short term", "working with leading mathematics teachers and co-ordinators (planning, teaching, evaluation)".

Others, however, questioned whether such detailed planning was necessary for all teachers, "Hours of planning", "Not enough time to plan and prepare and have a life", "Everyone is finding the workload very heavy, especially detailed planning". As one teacher pointed out, "Experienced teachers don't like having to write out all their daily lesson plans in such detail – especially as the next lesson often depends on the outcome of the last." The divide between those who welcomed detailed planning and those who felt it to be too detailed, clearly reflects very different needs. Common sense would suggest that all, from the newly qualified to the experienced, the mathematically confident to the not-so-confident, are unlikely to require the same level of planning. The teachers agree. The need to plan in detail would appear to alter at some point during the course of their teaching career, dependent on perhaps experience, confidence, how they feel about their teaching, the class they are taking, perhaps even the particular topic in hand.

There is, however, a further aspect here. Research from an elementary school in America looked at the link between planning and teaching (Shroyer 1981, quoted in Christiansen et al ed 1986). This research found that only 8% of "teachable moments" were optimised in lessons where detailed lesson plans were undertaken and closely

followed throughout. The intransigence and inflexibility of the teaching curtailed the breadth of mathematics, thereby missing opportunities to draw links between different aspects or make connections between various areas. Of the three teachers observed, the teacher who stuck most closely to the lesson plan avoided most of the "teachable moments", whilst the teacher most concerned with pupil understanding exploited most. Bromme and Brophy (in Christiansen et al ed 1986) found that teachers who plan in great detail concentrate "on how to present the subject matter but not on stimulating pupil involvement or understanding" (p.118). They are less likely to develop the ideas of the pupils or to encourage them. It is also possible that in so doing they remove some of the enthusiasm and excitement from the subject affecting the attitude and approach as a result.

The OFSTED (2001) report on the second year of the strategy found that for most teachers, their planning followed the three-part structure outlined within the strategy. Whilst the report acknowledged that many teachers found it time consuming, some of the schools were looking to options in order to try and lessen the workload. Examples of this included modifying plans for the following year, or planning in detail for the first few days of the week but in outline for the remainder thereby allowing for adjustment to meet needs. The report concluded that whilst this worked well, there was a danger that the teaching would become fragmented. According to Shroyer 1981 (quoted in Christiansen et al ed 1986) and Bromme and Brophy (in Christiansen et al ed 1986), however, that is also a danger where the planning is too detailed and adhered to without flexibility. It is interesting therefore that the OFSTED (2002) report on the first three years of the strategy, acknowledged that planning was most effective where the teacher adjusted her planning during the

course of the week. It concluded that, "Most teachers still plan in some detail, particularly in relation to the coverage of the framework's key objectives" (p.10).

8.5 The effect of strategy implementation on the confidence of two teachers.

In responding to this research the teachers were not required to record their name on the questionnaires, however, ten teachers chose to do so on questionnaire 1. To these teachers was therefore sent questionnaire 2. Only two, however, subsequently recorded their names on questionnaire 2. In so doing, they made it possible to compare their responses with regard to how their confidence progressed during the period from summer term 1999 to spring term 2000 - Teacher A and Teacher B.

Teacher A: Teacher A was an experienced teacher who qualified in 1976. As such she had more than twenty years of teaching service. During that time she had taught the entire age range, from four-year-olds to twelve-year-olds. Her experience was, however, heavily towards the younger end of the scale, having taught the 4-7 year olds for twenty years and the 8-12 year olds for only a year or two, the balance of that time. This experience was gained in first schools, middle schools and combined schools. Teacher A held both a Bachelor of Education degree as well as a Certificate of Education. She had responsibility for English throughout the school. With regard to National Numeracy Strategy training, she had received three one-and-a-half hour INSET sessions. Her previous mathematics training was "Sixteen years ago! Two terms with a working party to set up a curriculum prior to national curriculum".

In answering questionnaire 1 (undertaken in the summer term 1999, one term prior to National Numeracy Strategy implementation) Teacher A felt that greater mathematical subject knowledge was "of little importance" (question 5) but in

questionnaire 2 (one-term post strategy implementation) she felt it was "very important" (question 4). Clearly something had happened during the interim period to change her mind – quite dramatically in this case. Her response to other questions provided some clue as to why the change might have taken place.

This teacher reported feeling "completely confident" in "all aspects" at KS1 (questionnaire 1, questions 1). At KS2 and year 7 her confidence lessened – at KS2 she felt "completely confident" in "some aspects" whilst at year 7 she felt "completely confident" in "hardly any aspects". Her level of competence she recorded as exactly mirroring her levels of confidence at each key stage (questionnaire 1, question 2). As such, she reported being a confident and competent KS1 teacher in mathematics. Although an experienced teacher of more than twenty years, teaching across all class ranges from KS1 to year 7, the bulk of her experience was at KS1 (questionnaire 1, question 17). Given that she was not a mathematics coordinator and did not feel mathematics to be her strongest, most confident subject (questionnaire 1, question 16), this decline in confidence (and correspondingly in competence as she reported) was not entirely unexpected. It is also in line with the general trend emerging from this research (see Ch. 7 above). Teacher A believed that curricular changes since 1989 were necessary (questionnaire 1, question 11) and that the introduction of the National Numeracy Strategy was essential (questionnaire 1, question 15). Whilst Mathematics in the National Curriculum had not altered the way in which she taught (questionnaire 1, question 10), she expected the National Numeracy Strategy to change how she taught "a lot" (questionnaire 1, question 14). This would suggest that she was a teacher open to and expecting change.

With regard to training, Teacher A rated her own initial teacher training "poor" in most key areas – subject knowledge, teaching approaches, class management, lesson

planning, pupil assessment, competence and confidence (questionnaire 1, question 7). She felt that preparation in the areas of pedagogy and philosophy had been "quite good" but did not feel that her preparation was "very good" in any of the listed areas. As such, she felt badly prepared mathematically upon leaving college, with much to make up in terms of competence ("poor") and confidence ("poor"). Despite this need, however, the only long-term professional mathematics development she received was: "16 years ago! Two terms with a working party to set up a curriculum prior to National Curriculum" (questionnaire 1, question 17). It is therefore perhaps not surprising that in questionnaire 1 Teacher A placed observing experienced and effective teachers teach; more resources, text books, work sheets, teacher books; and more time within the school day for lesson preparation as the most important aspects for developing confidence and competence in mathematics teaching (questionnaire 1, question 5). She placed these factors higher than greater mathematical subject knowledge; a broader range of approaches and strategies; and greater knowledge of the pedagogy of teaching mathematics – the areas identified by the majority of the teachers in this research as the key areas for more confident and competent teaching in mathematics.

Given this background, Teacher A would appear to be a candidate for the government focus, "to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy" (Numeracy Task Force 1998, p.2). So what effect did National Numeracy Strategy training and implementation have, what could it offer this teacher given her particular needs? According to questionnaire 2 when asked whether she now felt completely confident teaching all aspects of the curriculum from reception to year 7, she reported feeling "mostly confident" but qualified her answer as "not at KS2 and 3", therefore reflecting little change from her previous position expressed in questionnaire 1 (questionnaire 2, question 10). When asked whether

strategy training had increased her confidence in teaching mathematics to her own class, she responded "only in Mental/Oral!" (questionnaire 2, question 1a) This reflected a very small improvement but in one particular area. Generally, Teacher A felt that as a result of National Numeracy Strategy training teacher confidence had increased "a little, for example, for the 'mental' focus" (questionnaire 2, question 9). She also believed that it had adequately prepared teachers for National Numeracy Strategy implementation "in some areas, for example, mental focus at the beginning of lesson" (questionnaire 2, question 1c). The mental focus seems to have had a great effect on this teacher but little else appears to have changed or improved. Why?

According to the HMI evaluation of the National Numeracy Strategy (OFSTED 2000), less than 2% of primary teachers have received the five-day training course led by numeracy consultants. Here is an experienced teacher, not a strong mathematician, but a teacher keen to undergo training. She appears to be open to new ideas, expecting to take on-board "a lot" of change into her practice. She is a teacher who like most primary teachers across the country received the three-day training. The result would appear to show little or no effect with regard to increasing her confidence and competence (implementing the strategy improved her practice but "only in the mental/oral sessions"). One aspect which has changed significantly, however, is that this teacher now places subject knowledge as the most important factor for developing teacher confidence in mathematics. She notes subject knowledge, methodology and class management/organisation as "very important" (questionnaire 2, question 4). What National Numeracy Strategy training (in terms of what it covered or what it failed to cover) and implementation would appear to have done is to emphasise for this teacher a particular need, a need previously not considered in the same regard or to the same degree (questionnaire 1, question 5).

When asked as to whether there was a lack of teacher confidence generally in the teaching of mathematics and if so to what she would attribute it, Teacher A responded, "Yes. Own subject knowledge and ability in maths. Those teachers who found it easy during their own schooling appear the most confident during INSET. Lack of advice about classroom management." (questionnaire 2, question 2) She also noted elsewhere, when defining confident teaching in mathematics, that "It helps to have good subject knowledge or to feel that you as a teacher are confident with the logical thinking that maths requires" (questionnaire 2, question 6). The National Numeracy Strategy – its training and implementation – would not appear to have succeeded for this teacher in terms of the Task Force focus of building up confidence (Numeracy Task Force 1998). It would, however, appear to have raised an issue of importance for her, alerting her to a particular need for confident teaching in mathematics.

Teacher B: Teacher B was an experienced teacher who qualified in 1969. As such she had almost thirty years of teaching service. During that time she had taught mainly year 1 and year 2 but was currently teaching reception and had been for two years. This experience was gained in infant schools and primary schools. Teacher B held a Certificate of Education. She had responsibility for Special Educational Needs throughout the school. With regard to National Numeracy Strategy training, she had received INSET in the autumn term. She recorded no other mathematics courses.

In questionnaire 1 Teacher B placed greater mathematical subject knowledge "very important" (question 5), however, in responding to questionnaire 2 she felt it was only "quite important" (question 4). An examination of her response to other questions provides a clue as to how and why she changed her view on this question. Teacher B

reported feeling "completely confident" in "all aspects" at KS1 (questionnaire 1, question 1). Her level of competence she recorded as exactly mirroring her level of confidence (questionnaire 1, question 2). She believed that confidence and competence were linked "a lot" (questionnaire 1, question 3). She failed to record any level of confidence or competence (questionnaire 1, question 1 & 2) at KS2 and year 7 (possibly because her experience included "mainly year 1 and year 2"), but circled all of the attainment target areas at KS2 and year 7 as being areas in which she did not feel completely confident and competent (questionnaire 1, question 4). As she taught in an infant school rather than a primary school this could also have reflected some lack of exposure and detailed knowledge at KS2 and what it entailed. She reported that she believed that curricular changes since 1989 had been necessary (questionnaire 1, question 11) and that she welcomed the National Numeracy Strategy (questionnaire 1, question 15). She acknowledged that Mathematics in the National Curriculum had altered how she taught "a lot" (questionnaire 1, question 10) and expected the National Numeracy Strategy to also change the way in which she taught "a lot" (questionnaire 1, question 14).

When asked after National Numeracy Strategy training and implementation in questionnaire 2 whether she would feel completely confident teaching all aspects of the mathematics curriculum to all classes from reception to year 7, her reply as in questionnaire 1 was still qualified and restricted to KS1, "mostly confident but not at KS2" (questionnaire 2, question 10). She confirmed in another question that training had not increased her confidence teaching mathematics to her own class, "No – just changed the focus" (questionnaire 2, question 1a). Having received three days of allocated National Numeracy Strategy training and having implemented the strategy for a term, there appeared to be little if any benefit to this teacher in terms of the Task

Force focus (Numeracy Task Force 1998). Whilst acknowledging a general lack of teacher confidence in the teaching of mathematics, she recorded with reference to herself, "As we are an infant school – we feel confident – but doubt we would cope if transferred to the next key stage" (questionnaire 2, question 2). She reported feeling that generally speaking teacher confidence had only increased "a little" as a result of National Numeracy Strategy training (questionnaire 2, question 1a) and "a little" as a result of strategy implementation (questionnaire 2, question 1b), reflecting "just a change in focus now". This reflection, however, is based upon an infant school where teachers are already confident and where confidence has less room for improvement being already very high. At a primary school this would not necessarily be the case, as even though a teacher may herself be teaching a KS1 class, she would be exposed to training, conversation and work relating to KS2. Clearly therefore the question of confidence at KS2 is a very different matter, a level where this teacher records, "we feel confident – but doubt we would cope if transferred to the next key stage".

Despite the appearance of little change, Teacher B has between questionnaire 1 and questionnaire 2 undergone a slight change to her beliefs and values. She has altered the importance of subject knowledge with regard to increasing teacher confidence at KS1. Why? One possible explanation is that as an experienced and confident KS1 teacher she has progressed beyond the point of what is being taught and is now concentrating on improving and maximising how it is taught. Prior to National Numeracy Strategy implementation she may have felt unsure as to what was required under the new system, the degree of change necessary. As she herself notes, however, confident teaching in mathematics is about being "able to introduce new ideas and styles with confidence and flair" (questionnaire 2, question 6). Indeed, having the courage and ability to consider and successfully implement change into practice as she

has done, demonstrates this high level of confidence (Irwin & Britt in Jaworski et al ed 1999). National Numeracy Strategy implementation caused her to examine and question what she is doing, how and why. As such, her beliefs and values would appear to have altered in line with the new changes, reflected now in her practice. It is therefore unsurprising that this teacher no longer reports subject knowledge to be as important for developing confidence, she has moved beyond it having already successfully implemented the required change. The fact that her subject knowledge and confidence are already high at KS1 plays a significant part in this change.

The situation with regard to KS2, however, could be very different. As she is neither exposed to KS2 pupils in her school, to training at that level in INSET, to daily conversation amongst colleagues teaching that age range, or to work undertaken and displayed within the school, it is not an area she needs to consider. She acknowledges a lack of experience and a lack of confidence at KS2 and year 7, "as we are an infant school – we feel confident – but doubt we would cope if transferred to the next key stage" (questionnaire 2, question 2). This raises a question, one outside the scope of this work but worthy of consideration perhaps at some point in the future. It concerns those teachers who unofficially specialise within a certain age range or who stay within certain key stages for most of their teaching career. Is it personal preference, is it because of their knowledge and experience, or is it simply that they feel more confident and therefore more secure and comfortable at that particular level? Also, as discussed earlier, to what degree could a move into a different key stage – in the case of Teacher B to a KS2 class - affect the confidence and competence of that teacher?

8.6 Questionnaire 3 and the focus group discussions.

The focus group discussions were undertaken immediately prior to questionnaire 3 and were recorded in field note form (see Ch. 5 above). They involved twenty-five teachers in the first group and twenty-one teachers in the second. The same teachers responded to questionnaire 3 (forty-six). As such, the data from each adds support to the other. As the discussions took place first, it is possible that the awareness of those partaking was heightened with regard to the question of teacher confidence. This could have been reflected in their responses to questionnaire 3.

Validation was provided in a number of areas concerning how the teachers perceive and understand confidence.

With regard to confidence: The teachers in the focus groups confirmed that confidence is very important to them. It affects key aspects of their practice including how they teach, how they perceive their teaching, and how they feel about the subject. It affects their attitude towards mathematics. This attitude, be it positive or negative, passes on to the pupils, affecting in turn their enjoyment, learning, enthusiasm, perseverance and sense of having-a-go. It also, as one teacher demonstrated from her own situation, affects the ability and willingness of the teacher to adopt change successfully into practice. Responses to questionnaire 3 confirmed that confidence is important to the teachers in terms of how they teach (forty-five teachers, 98.7%, n=46, one teacher did not respond to this item) and how they perceive themselves as teachers (forty-one teachers, 89.1%, n=46, five teachers did not respond to this item). None of the teachers believed that confidence was not important in either respect (questionnaire 3, question 3).

The teachers in the discussions reported a very close link between confidence and competence. Indeed some felt the link was obvious, beyond discussion. This

closeness was further recorded in questionnaire 3 where the level of increase for confidence and competence arising from the strategy (inquired into separately) was rated identical - in positive (with forty-three teachers, 93.5%, n=46) as well as negative terms (one teacher felt that her confidence and competence had not increased as a result of the strategy and two did not respond to this item) (questionnaire 3, question 4). The teachers reported that confidence was visible in the most basic aspects of their teaching – their attitude, approach, pace, ability to move around the subject, use of resources, rigour, classroom management, ability to differentiate at all levels, coping with the unexpected, identifying and handling problem areas. Despite this importance, however, most of the teachers (thirty-five, 76.1%, n=46) believed that a lack of confidence still exists generally (nine (19.6%, n=46) disagreed and two did not respond to this item) (questionnaire 3, question 2). Again this confirms earlier findings in questionnaire 2 where most reported a lack of confidence one term post strategy implementation (see 8.1 & 8.2 above). The discussions confirmed that confidence does not necessarily exist across the entire primary range. Some teachers expressed apprehension at the thought of moving to a level or class in which they felt less confident. One teacher acknowledged that she was completely confident at "year 3", another at "year 1 and year 2". This was not unusual. Where limits in confidence were reported it tended to arise from certain age ranges or key stages. The teachers also confirmed a decline in confidence as the degree of mathematical difficulty rises – thirty-four (73.9%, n=46) felt completely confident at KS1, twenty-five (54.4%, n=46) at KS2 and ten at year 7 (21.7%, n=46) (questionnaire 3, question 5). This decline is not unexpected, it ties in with data from the other questionnaires.

Whilst experience was not rated highly in questionnaire 1 in terms of confident practice, the teachers in the focus groups felt that confidence could increase through the development of secure mathematical knowledge, by increasing strategies for teaching, and through better management and organisational skills – elements which can develop through experience. Additional training courses, better resources, observation of good practice, support from good mathematics advisors and coordinators, personal effort and time, were all identified as important ways of aiding their development.

With regard to the impact of the strategy on confidence: All of the teachers welcomed the implementation of the National Numeracy Strategy (questionnaire 3, question 1) and believed it to be necessary. Almost all felt that confidence and competence had increased as a result. Most also acknowledged (thirty-nine, 84.8%, n=46) that they enjoyed the subject more (questionnaire 3, question 4). The teachers identified professional discussion amongst colleagues, observation of good practice, and the five-day training course as factors that helped in this development.

Within the discussions some who still lacked confidence said it was because they felt they were not good at the subject. One teacher acknowledged problems implementing the strategy. She felt particularly threatened by the mental/oral starter, "why can't we write it down?" She believed it was easy to assume that most teachers were confident, that most could cope with a few days of training. Yet she believed she was not alone in having problems. She didn't dislike mathematics, was keen to improve her knowledge and confidence, but wanted and clearly needed greater support and guidance. Attendance at the five-day training had helped but as she said, it was only a start. She was also concerned that it would now be assumed

by her school that she was OK - happy, ready and able to continue alone having had training. The reality was that she felt far from ready. Furthermore, she was clearly not prepared to expose the depth of her feelings openly - she raised her concerns directly with me, not in front of the group. It is therefore highly possible that her school remains unaware of the full scale of the problem. It is also possible that there may be others like her - as one teacher reported, confidence affects practice "Greatly. Children don't miss a trick therefore some teachers must fake confidence at times!"

The majority of the teachers agreed that the three-day training had helped but only in so far as it went. Most (84.8%) believed that more mathematics training is still needed (questionnaire 3, question 7). The discussions confirmed that the three-day strategy training was too short given what had to be covered. It was too little too late. Other shortcomings were also highlighted, confirming those already noted in questionnaire 2 (see Ch. 6 above). By comparison, the teachers rated the five-day training highly in the discussions, with benefit unanimously acknowledged in terms of increasing knowledge, confidence and competence. Several likened it to the GEST courses in style and effect. It was strongly argued that the five-day training should be available for all who wished to attend, not just for subject coordinators. Training needed to address different levels. Several of what appeared to be the more experienced and confident coordinators felt that they too could still benefit from training, but not at the same level. Funding and a lack of time were highlighted as issues – for example, to buy in resources, to cover supply teachers, to allow observation of good practice and to release coordinators to work with others.

One further issue was raised by the teachers, raised briefly in the focus group discussions, recorded in questionnaire 3, and referred to by some teachers informally over coffee. Reported in questionnaire 3 (question 9), several of the teachers "found discussion was beneficial", "very useful", "interesting issues" and "very informative". This could have been interpreted in an information gathering sense. Some, however, qualified their response further, "very interesting to hear other teachers feel the same", "Interesting to find out from the results of the survey where other teachers worries/interests lie, and how alike the thinking in the teaching profession is". This would appear to highlight insecurity and a need for reassurance, "Interesting and reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often! That's the teaching profession!!" The strength of feeling is evident in the use of exclamation marks. The message is unambiguous, "reassuring to find out that I am not alone". The degree of benefit and support is demonstrated through the choice of words, "reassuring", "many teachers feel the same". Furthermore, this was not an isolated opinion. Several teachers commented informally on for example, the benefits of time away from school to think, of having the opportunity to discuss their practice and views with others, on the usefulness of sharing good ideas, on the need to avoid reinventing the wheel at every turn, and on the importance of sharing the work that has already been done.

What is most interesting is the fact that this was raised by the teachers mainly in a one-to-one/small group situation or in anonymous written form within the questionnaire, with only the briefest of mention in the larger group situation. It suggests that teachers may not wish to discuss their fears or insecurities in public. They may not want colleagues to see that they experience problems or have

concerns. Indeed, certain similarities can be seen between this and the situation with Emily described earlier (Irwin & Britt in Jaworski et al ed 1999). Given this reticence, it is possible that some teachers could be retaining and bottling up their problems, unaware that others may also experience similar problems and worries – as demonstrated here. The danger of course is that they have less chance of resolving the problem where it is hidden from view. Also, problems can often grow larger when left un-addressed.

Whilst further research would have to be undertaken to determine whether this is an isolated incident involving a few teachers or a more widespread problem, the fact that the teachers raise it within the context of this particular discussion is interesting in itself. It is possible therefore that not only do "primary teachers tend to have less confidence about their teaching skills and subject knowledge in this area" (Numeracy Task Force 1998, p.21) but they may need "reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often!" Indeed, this could go some way towards explaining why the increase in confidence was perceived by the teachers to be higher generally than recorded personally. It could explain why the teachers chose to respond to this research at a time when workloads were particularly heavy and time a valuable commodity. It could also explain why several wrote beyond what was requested, recording their views on the top, bottom, sides and back of the questionnaires. Interestingly, less than half of the teachers responding to the OISE/UT (Earl et al 2003) external evaluation report felt they had sufficient opportunity to work with colleagues on mathematics teaching and learning (p.105).

8.7 A summary of the findings.

Chapter 8 reports on teacher confidence post National Numeracy Strategy training and implementation. The main source of data is questionnaire 2, reporting the views of sixty-one teachers, and questionnaire 3, reporting the views of forty-six teachers. Validation is provided through the two focus group discussions (twenty-five teachers took part in the first discussion and twenty-one teachers in the second).

The teachers report that the National Numeracy Strategy had a positive impact on confidence. No teacher did not welcome it (questionnaire 3, question 1), all who responded believed that implementing it improved teaching effectiveness (questionnaire 2, question 13). The majority felt that confidence had increased, 'a little' as a result of strategy training but 'a lot' as a result of implementation (questionnaire 2, question 1). This difference they attributed to limitations within the training (the three-day training provided too little too late, was too close to implementation and failed to address the needs of all) and benefits arising from implementation (most especially, the "structure of the lesson is clearer", "structured approach laid out", "much more focus" and "clear structure for progression") (questionnaire 2, question 1, 3). However, whilst fifty-nine of the teachers (n=61) believed that confidence increased generally to some degree as a result of strategy training, only forty-one (n=61) of the same teachers felt that their own confidence in teaching mathematics to their class had improved as a result of the same training (questionnaire 2, question 1 & 9). Furthermore, despite having just completed the five-day training course and with twenty subject coordinators amongst the respondents, thirty-five (n=46) of the teachers still believed there was a lack of confidence amongst teachers generally in mathematics (questionnaire 3, question 2). This lack of confidence was felt to be greater at KS2 than at KS1, "we are an infant school – we feel confident – but doubt we would cope if transferred to the next key

stage" (questionnaire 2, question 2, questionnaire 3, question 5). One year on almost half of the teachers still felt they needed greater confidence with regard to subject knowledge and in their teaching of mathematics (questionnaire 3, question 2) – which the teachers identified as the two key factors for confident mathematics teaching (questionnaire 2, question 6).

There was one area over which the teachers disagreed, detailed planning. For some detailed planning was very necessary, they believed that it benefited their practice and contributed to their confidence. Other more confident teachers, however, felt that "experienced teachers don't like having to write out all their daily lesson plans in such detail – especially as the next lesson often depends on the outcome of the last". As one teacher noted, "Not enough time to plan and prepare and have a life".

With regard to validating the conclusions, questionnaire 3 and the focus group discussions confirmed the importance of confidence in terms of how the teachers teach and how they perceive themselves as teachers. They confirmed that confidence is visible in the most fundamental areas of their teaching, affecting how they teach, how pupils learn, what the teacher feels about the subject, what the pupils feel, and the ability and willingness of the teacher to adopt change successfully into practice. If confidence is visible, however, then so is a lack of confidence. The teachers reported a link between confidence and competence, with identical levels of increase for each when assessed separately, both with regard to those who express high levels of each, and for those who acknowledge that they have hardly any. The majority of the teachers still believe that they personally needed greater confidence in their subject knowledge and also with regard to implementing the curriculum. They were unanimous in their call for more training in

order to address subject knowledge and teaching strategies. They acknowledged particular benefit from the five-day training course, which came highly recommended by the focus group teachers but which they argued should be available for all teachers. Differentiation was necessary, however, to cater for teachers at different levels. As one teacher commented, even the subject coordinators needed in-service, as it kept them current and aware of the latest thinking which was important if they were to lead other staff within the school. Differentiation would also maximise learning and benefit. Some of the teachers within the discussions who still lacked confidence reported that it was because they felt they were not good at the subject, confirming the importance of what teachers feel and believe, as well as what they know and do. As one teacher pointed out, it is easy to assume that most teachers are confident, that most could cope with a few days of training.

One issue raised was the fact that it was "very interesting to hear other teachers feel the same", "Interesting and reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often! That's the teaching profession!!"

Chapter 9: Conclusions and recommendations arising from this research.

The aim of this research was to inquire into the question of teacher confidence in primary mathematics. By examining a range of views expressed by the teachers in written and verbal form, and by considering the implications of those views for mathematics education, this work sought to add to the existing knowledge base with regard to teacher confidence. The primary justification for this inquiry arose from the introduction of a new national strategy for the teaching of mathematics. Through the National Numeracy Strategy, the government sought to obtain higher standards of pupil achievement, resulting from more effective teaching, "The main focus of the Task Force's work has therefore inevitably been at the level of teachers' individual effectiveness, as this will make the crucial difference to individual pupils' achievement in numeracy" (Numeracy Task Force 1998a, p.12). To that end one particular route was outlined with regard to more effective teaching, and therefore learning, in mathematics, "We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy." (Numeracy Task Force 1998, p.2) There are three elements to this statement. First, it notes the importance of confidence as one of two key factors for more effective teaching and higher levels of achievement. Second, it notes the need to increase teacher confidence thereby highlighting the fact that it believes a lack of teacher confidence currently exists. Third, it emphasises the urgency of doing so quickly thereby noting the importance of confidence to the successful implementation of the strategy. Whilst neither explaining nor defining what precisely is meant by confidence, nor how it is manifested in practice, the Preliminary Report notes, "we want teachers and pupils to be confident and positive towards the subject" (Numeracy Task Force 1998a, p.9).

The fact that the Task Force and government believe it to be so does not, however, mean that teachers will necessarily be in agreement. Whilst much has been written in recent years on the question of teacher competence, far less is recorded on teacher confidence. This work therefore inquired into teacher conceptions of confidence - given the importance outlined by the government, the lack of definition, and the fact that what teachers believe carries some significance in terms of what they do in the classroom and their degree of effectiveness in so doing (Askew et al 1997, Senger 1999, Manouchehri & Goodman 2000). On the basis of a range of views expressed by the teachers in written and verbal form, by way of three questionnaires and two focus group discussions (see Ch. 5 above), this work inquired into –

- what the teachers believe confidence to be;
- whether, and if so the degree to which, teachers feel confidence important to their practice;
- how they believe confidence affects that practice.

As the Final Report (Numeracy Task Force 1998) notes not only the importance of confidence, but also the need to increase levels quickly, this work also inquired as to whether the teachers –

- believe they lack confidence, and if so, the degree to which they perceive that lack and why.

In addition, given that the government provides a programme of training and support through which confidence can be built-up, this work also assesses –

- what the teachers believe the impact of the strategy to be on confidence.

Prior to embarking on this discussion (see Ch. 6, 7 & 8 above), however, it was first necessary to outline the background to the strategy, from whence it and this Task Force focus emerged, and why (see Ch. 2 above). It was necessary to inquiry into the strategy itself, what it contained and what it required of teachers (see Ch. 3 above), and in so doing to identify the degree of change required of teachers – thereby also outlining the context in which the government expected teacher confidence to be built, as well as providing an indication of the scale of the problem perceived, given the programme of allocated training through which the problem was to be addressed. It was also necessary, given a lack of definition within the strategy and associated paperwork, to examine through the literature what confidence is (see Ch. 4 above). Having set down the methodology for this research (see Ch 5 above) - the research design, the collection of data and its analysis - an examination of the data began through which several patterns were identified in the responses of the teachers. More individualistic attitudes were also highlighted. Chapter six examined the expectations and attitude of the teachers towards the strategy, set down in their response to questionnaire 1. It examined how they felt its adoption would affect practice. Chapter seven provided an account of teacher confidence from the view of the teachers, whilst chapter eight reported the views of teachers one-year after strategy implementation.

This chapter now outlines the findings and recommendations of this research – addressing the earlier chapters (Ch. 2, 3 & 4) according to the chapter in which they were discussed, and reporting the data chapters according to several of the main research questions.

9.1 Chapter 2.

Chapter 2 inquired into the background of the National Numeracy Strategy and the Task Force focus, from whence it came and why, given that as Fullan (2000) suggests, its introduction is partly due to the fact that past educational initiatives have not had a great record of success. It outlined changes since the 1950's, important on a number of fronts. First, because the teachers reported the quantity of changes in recent years as a lesser but still significant factor affecting confidence, also the increased workload that emerged as a result (questionnaire 2, question 2). Second, because the teachers identify a general lack of time (questionnaire 2, question 2) within the school day, where the curriculum has increased steadily during the twentieth century. This has happened in two ways, generally where additional subjects have been introduced over the years; and in mathematics itself, where new areas such as graph work, statistics and technological aspects, have been added. Whilst much has been added, little has been removed, leading to a steady increase in what is required but with no corresponding increase in time. The danger of broadening the curriculum in such a way is that it exposes a conflict - quantity (the amount being covered) versus quality (the depth to which each is covered). Third, it gave an indication of the background from which most of the teachers responding to this research emerged - interesting as many attributed what they perceive as a lack of teacher confidence to their own experiences as a pupil, identified by the teachers alongside subject knowledge as one of two key factors (questionnaire 2, question 2).

Arising from this discussion, one issue emerged which carried possible implications for strategy implementation and teacher confidence – the successful adoption of change into practice. Recommendations of good practice were put forward in reports such as Hadow (1931), the Mathematical Association (1955) and Cockcroft (1982), however, the need to reiterate recommendations in subsequent reports would

suggest that not all were taken on-board and universally adopted by teachers in the classroom (Mathematical Association 1955, Cockcroft 1982, Desforges & Cockburn 1987, Numeracy Task Force 1998 & 1998a). Furthermore, despite several initiatives to improve teaching and learning, concerns continued to be expressed with regard to standards of achievement (HMI 1989, Sutherland & Pozzi 1995, London Mathematical Society et al 1995, OFSTED 1995, OFSTED 1997, Numeracy Task Force 1998a). The implications for the confident and competent implementation of yet another new initiative, a strategy outlining not only what was to be taught but how, are clear.

9.2 Chapter 3.

Chapter 3 inquired into the National Numeracy Strategy, examining the Framework for Teaching Mathematics (DfEE 1999) in terms of content, approach, planning, structure and philosophy. In so doing it demonstrated the context in which teacher confidence was expected to grow and the degree of change involved. It also, through an examination of the programme of allocated training, provided an indication of the scale of the problem as perceived by government, given that the training was designed to address the Task Force focus (Numeracy Task Force 1998) and prepare teachers for implementation. Two issues emerged from this discussion.

First, the fact that the strategy is based upon and promotes one particular philosophy of mathematics education, a philosophy which teachers are required to adopt regardless of their own beliefs concerning teaching and learning in mathematics. The fact that these two philosophies – that promoted through the strategy and that to which the teacher already holds - may not be the same was likely to emerge as an issue, given that beliefs do not generally change quickly (Thompson 1992, Pajares 1992, Ernest 1994, Poulson et al 2001, Stipek et al 2001). Confidence has been shown to help

the successful adoption of change, in terms of changing beliefs and changing practice (Fresko & Ben-Chaim 1986, Irwin & Britt in Jaworski et al ed 1999, Manouchehri & Goodman 2000), both of which were required in this case. The suggestion therefore was that the teachers would have the confidence and the competence so to do. But do they? Furthermore, is it not a somewhat surprising expectation given that the Numeracy Task Force (1998) also noted the urgent need to build up the confidence and competence of the same teachers as quickly as possible? There would appear to be a conflict between what was expected and what was identified as needed. Indeed, it could provide acknowledgement that one was necessary for the other to occur. Either way, the adoption of change, the altering of teacher beliefs, and the increase of confidence, were key factors within this.

The second issue to emerge was the provision of a standard three-day cascade training programme designed to cater for all teachers regardless of their experience, subject strength, competence and confidence. It was through this training that confidence and competence were to be built and teachers prepared for implementation. The provision of only three days of standard training, however, suggests neither a large-scale nor deep-rooted problem. Again this appears not to tie in with the urgent need emphasised by the Task Force elsewhere, nor reflect the scale of the task required. As such, and bearing in mind the fact that only 2% of all primary teachers had received the five-day training by the end of the first term of implementation (OFSTED 2000), it must be assumed that the vast majority were implementing the strategy on the basis of the three-day training run by the subject coordinator. This was confirmed by the OISE/UT (Earl et al 2003) external evaluation of the strategies, "many teachers have not had any direct input from anyone outside the school." (p.41)

Whilst not necessarily an issue where the coordinator is confident and competent in her mathematics and in her provision of mathematics training, and the teachers report many who were, "not enough training – luckily we have a very good coordinator", what if she is not? Furthermore, as OFSTED (2000) points out, no training was given to coordinators in how to train others. There is also the fact that as Webb (1993 & 1994) concluded, some mathematics coordinators obtained their position because of school circumstances or default rather than through their own high level of knowledge and skill within the subject. As one teacher commented, "We can all read, our training was the trainers reading our handouts." (questionnaire 2, question 14) Changing behaviour or sustaining an improvement to practice requires more than information and guidance (Earl et al 2003). Long-term courses have been shown to be effective in establishing beliefs (Webb 1993) and are greatly valued by teachers (Webb 1994). Highly effective teachers of numeracy have generally undergone courses of professional development (Askew et al 1997). Any change to practice or beliefs, however, can only be sustained through regular further attendance (Sumner 1974).

9.3 Chapter 4.

Chapter 4 looked at confidence through the literature, given a lack of definition in the strategy and the associated paperwork. It established that confidence concerns "a belief in one's ability to be effective and to take on challenges" (Hay McBer 2000, p.19). Confidence involves self-reliance and boldness. It is to do with efficacy, with the features of best teaching involving "a confident command of the subject, a driving pace to lessons and extremely ambitious and unusually high expectations" (OFSTED 1997a, p.6). On the other hand, "Weaknesses in teaching frequently related to teachers' lack of confidence and subject expertise" (OFSTED 2000, p.9-10), where "Less confident

teachers are uncertain about their roles and have a view that there is a 'preferred' way of working which does not change" (p.9-10). Numeracy consultants noted 'the mass of misunderstanding' as well as the 'lack of confidence in some teachers who feel unable to be flexible' (Earl et al 2003, p.74).

Confidence affects how the teacher feels about her teaching (Fresko & Ben-Chaim 1986). The teacher who lacks self-confidence and does not enjoy mathematics experiences difficulty fostering confidence and enjoyment in her pupils (Stipek et al 2001, Irwin & Britt in Jaworski et al ed 1999, Ernest 1994). It affects her attitude, where teacher confidence feeds a more positive teacher attitude (Buxton 1981, Bell et al 1982, Bromme & Brophy in Christiansen et al ed 1996). This attitude is visible to pupils, who take it on-board (Carter in Cornelius ed 1982). Confidence leads pupils to greater confidence and achievement. The pupil through greater enjoyment shows more perseverance and strives harder to fulfil expectations, leading to greater confidence, enjoyment and achievement, which is self-perpetuating (Burns 1982, Askew & Wiliam 1995, Earl et al 2000 & 2000a, Hay McBer 2000).

Confidence is affected by secure connected subject knowledge, which some primary teachers lack (Bromme & Brophy in Christiansen et al ed 1986, OFSTED 2000, OFSTED 2001 & 2002, Earl et al 2003). Teachers who lack secure connected subject knowledge were also found to lack confidence in their teaching ability (Fresko & Ben-Chaim 1986). Given that the teachers in this research dated their own lack of confidence to insecure subject knowledge and to their own experiences as a pupil, it is interesting that a group of PGCE students (Underwood & Cavendish 1997) record a lack of confidence and fear of mathematics as the most negative influence on their teaching. They identified confidence in the teaching of mathematics as a major concern. For the PGCE students in Barrington and Harries (1999) study, however,

confidence increased as a result of increasing their subject knowledge. The OISE/UT (Earl et al 2003) evaluation of the strategies acknowledged that, "primary teachers had much greater confidence about teaching literacy than they had about teaching mathematics." (p.128) Indeed, the Gatsby Foundation (1995) highlighted a "lack of knowledge and confidence " (p.41) as a pointer for future action as far back as 1995.

Chapter four also looked at the role of confidence in the adoption of a new initiative, given that the teacher has an important role in facilitating the introduction of beneficial change and improvement in mathematics education (Howson & Mellin-Olsen in Christiansen et al. ed 1986, Earl et al 2003). Confidence helps the adoption of change (Irwin & Britt in Jaworski et al ed 1999), there being a high correlation between knowledge, confidence and the degree of change teachers can adopt into practice (Dorfler & McLone in Christiansen et al ed 1986, Irwin & Britt in Jaworski et al ed 1999, Senger 1999). Meaningful change, however, does not occur unless the teacher is motivated to try out new ideas, unless she is given the opportunity to develop relevant skills and knowledge, and unless she works in contexts supportive of the change (Earl et al 2003). Nor does it occur merely by providing new materials, but by initiating and guiding the development of understanding. Support is needed to maintain that change (Manouchehri & Goodman 2000). An analysis of several research projects showed the adoption of curricular and philosophical change to centre mainly on four elements: the teacher's ability to implement that change - her knowledge and skills; her desire for change - her confidence and motivation; her beliefs - how and why the strategy is being implemented, its value, security of tenure, and the reality of how it can be implemented in the context of her particular situation, existing knowledge and experiences; and the context - the support and training provided in preparation (Wilson 1998, Irwin & Britt in Jaworski et al ed 1999, Senger 1999, Manouchehri & Goodman 2000, OISE/UT

2003). Educational reform requires that teachers are committed to the reform rather than compliant with it (Fullan with Stiegelbauer 1991). A danger is that teachers adapt new ideas to suit their own particular context, thereby not only weakening the initiative but also possibly leading back to old practices (Earl et al 2003).

Chapter four also looked at teacher beliefs given that confidence is a belief in the teacher's ability to be effective. Having developed over time and being influenced by the teacher's own experiences at school, her initial training, colleagues, courses, the literature, research and her teaching (Marino 1998), teacher beliefs are likely to be deeply embedded and slow to change (Ernest 1994, Poulson et al 2001, Senger 1999, Stipek et al 2001). Arising from these beliefs, the teacher will have determined views on, for example, why we teach mathematics, how pupils learn, what we should teach, how we should teach, and what questions we should ask. A body of research supports the value of teacher beliefs in the teaching and learning of mathematics (Kagan 1990, Thompson 1992, Ernest 1994, Marino 1998, Senger 1999). It has shown a connection between the beliefs of the teacher and the effectiveness of her teaching (Thompson 1992; Ernest 1994b; Askew et al 1997; Senger 1999, Stipek et al 2001; Poulson et al 2001). It has also shown a relationship between the beliefs of the teacher and pupil learning, arising from the mathematical experiences to which pupils are exposed (Cobb et al 1993, Almeida & Ernest 1995, Middleton 1995, Manouchehri & Goodman 2000, Stipek et al 2001). Highly effective teachers of numeracy are distinguished from others by a particular set of beliefs and understanding that underpin their teaching (Askew et al 1997). These include beliefs about what it is to be numerate; how pupils learn to become numerate; and how best to teach pupils to become numerate. Not all beliefs are effective, however, Dewey (1933) notes three types of negative belief – beliefs that are based upon authority, based upon emotion, and upon limited reason. By requiring a

particular way of teaching, the Revised National Curriculum (DfEE/QCA 1999) is supporting the fact that teacher beliefs concerning what mathematics is, and how and why we teach it, play a key part in teacher effectiveness.

9.4 How the teachers define confidence.

An examination of the responses to questionnaire 2 reveals that almost all of the teachers report that confidence is primarily concerned with two aspects – secure connected subject knowledge, "Good basic knowledge of [the] subject", "teacher is secure in own knowledge", "it helps to have good subject knowledge or to feel that you as a teacher are confident with the logical thinking that mathematics requires"; and sound teaching, incorporating a variety of strategies and teaching approaches, good classroom organization, and addressing particular class and individual needs, "good subject knowledge delivered in a variety of ways to stimulate children", "Able to use a variety of teaching strategies to engage all children", "To be able to work at each individual child's level and be able to move their learning on." The teachers in many cases noted a third element alongside one or both of these, a positive enthusiastic attitude, "Confidence re-knowledge of subject, teaching and assessing effectively. Also an enjoyment of teaching maths". A confident teacher "exudes an excitement about the subject", "Energetic, enthusiastic, exploring and discussing different methods. Using skills already learnt to increase children's understanding, building on concepts" (questionnaire 2, question 6).

Confidence therefore is "Knowing the subject and being able to teach it and present it in an interesting and exciting way", "the teacher knows the pupils' abilities and can differentiate as necessary. The teacher thoroughly understands the subject matter and how this fits into the 'bigger' picture." Confidence is a "Good basic

knowledge of subject, enthusiasm, knowing where children have come from mathematically, where they are now and where you want them to be – therefore how to get them there!" As such the teachers see confidence in terms of what they know, how they use that knowledge in their teaching, and how they feel about the subject. They also reported that they believe confidence to be a very visible aspect in their teaching, where "children are aware of teachers' confidence", "children quickly pick up vibes". If confidence is visible, then so is a lack of confidence, "Children are aware of the teacher's confidence", "The children can often tell how confident a teacher is". This may explain why one teacher noted, "Children don't miss a trick therefore some teachers must fake confidence at times!"

9.5 Why the teachers believe confidence is important.

None of the teachers in this research believe that confidence is not important. The teachers report that confidence is very important, rather than quite important, "confidence is essential", "confidence = good + ", "confidence gives better practice", "the more confident, the better the practice" (questionnaire 2, question 7). It is "an important factor", an integral part of effective practice (questionnaire 1, question 3; questionnaire 2, question 2, 4, 6 & 11). All acknowledged that confidence is important in terms of how they teach mathematics and how they perceive themselves as teachers (questionnaire 3, question 3), "If teachers are confident the lesson becomes more enjoyable, varied and interactive" (questionnaire 2, question 7). It is seen to affect fundamental parts of their practice. It affects the attitude of the teacher, how she feels about the subject, an attitude that rubs off onto the pupils and is adopted by them, "confidence in teacher builds confidence in pupils" (questionnaire 2, question 2 and 7). It affects the teachers' and pupils' enjoyment of the subject, and the pupils' desire to

learn, "the teacher is more relaxed, enjoys teaching and the children respond" (questionnaire 2, question 7). It also affects pupil achievement, "if the teacher is confident, then the children learn more easily" (questionnaire 2, question 7).

9.6 How the teachers believe confidence affects practice.

Confidence affects practice "completely", "Significantly", "very much", "Strongly!", "Greatly", "All the time". It is, "Essential" because "confident teachers teach well", "If teachers are confident the lesson becomes more enjoyable, varied and interactive", "The more confident, the better the practice", "At the core of planning and implementing effective lessons". Confident teachers "teach well", "tackle any situation that arises effectively" and are "Not afraid to take risks, experiment, allow children to explore" (questionnaire 2, question 7). The teachers report that confidence gives them flexibility and provides security when moving around the subject, not fragmenting the mathematics, it is "being able to move beyond their planned lessons and able to adapt/ revise spontaneously as required" (questionnaire 2, question 6).

The majority of the teachers believe that confidence and competence are linked "a lot" rather than "a little". None of the teachers believe they are not linked (questionnaire 1, question 3). Levels of confidence and levels of competence, measured separately at both the top and the bottom of the scale with regard to those who feel very confident and those who do not, are recorded almost identically by the teachers in questionnaire 2. Even when movement occurs upward or downward between the key stages, the closeness is maintained with a maximum difference of three teachers at any one point, with regard to those who feel completely confident (questionnaire 1, question 1) and those who feel completely competent (questionnaire 1, question 2) at each of KS1, KS2 and year 7. In support of these findings, the teachers in questionnaire

3 and the focus group discussions measure confidence and competence identically at both the top and the bottom of the scale.

According to the responses of the teachers, confidence affects pupil attitude and achievement, "Confidence is essential and has [a] bearing on confidence of children and outcomes", "Confident teaching in mathematics inspires confidence and enthusiasm for the subject and its possibilities in children". This positive enthusiastic attitude has a positive enthusiastic effect, it "rubs off on pupils", "Confidence in teacher builds confidence in pupils", "confidence rubs off on the children – confident teachers will produce good lessons", "If you are confident you give more enthusiasm to the children and a willingness to learn", you can "motivate and sustain children's enthusiasm for mathematics", "the confident teacher can enthuse the pupils with a sense of excitement, wonder and an 'I can do this' attitude. Maths can be fun!" A confident teacher "enhances pupils opportunities". As a result the teachers report evidence of "pupils increased enjoyment", "Children become more confident", "Confidence = enthusiasm = knowledge = gain", "Children's understanding is improved and standards are raised". This occurs because confidence "affects the whole lesson(s), your enjoyment therefore children's enjoyment". As a result, learning is maximised, "If the teacher is confident, then the children learn more easily", "Lower achievers are more confident – achieving above average results". The implications of a teacher who lacks confidence are also noted, "If you are not confident I believe it passes onto the children" (questionnaire 2, question 6).

9.7 Why the teachers believe they lack confidence.

The teachers attribute their lack of confidence primarily to two factors – insecure subject knowledge and their own experiences at school, "My own insecurities stem

from my perception that mathematics is difficult, my lack of knowledge/confidence and how I was taught", "The way the teachers were taught themselves and not understanding maths", "in our school on the whole the majority do lack confidence, due to own knowledge and expertise, own experiences of numeracy at school". With regard to their own experiences as a pupil the teachers report, "I attribute it mostly to teachers experiences when they were pupils", "due to own past experiences as pupils", "The way teachers have been taught maths themselves", "to poor maths teaching when they were at school", "Poor maths teaching when they themselves were pupils", "Own personal experience of maths teaching", "Lack of ability due to inadequate teacher training", "Some teachers show lack of confidence, mainly because of their own experiences in learning mathematics", "because many teachers struggled with maths themselves", "many do not have a 'strong mathematical background', tend to look back at their own (unsatisfactory?) experiences as a pupil" (questionnaire 2, question 2). The teachers report gaps in their own subject knowledge, "Usually due to feeling a 'failure' themselves in this subject area", "Lack of personal subject knowledge", "Our own subject knowledge and ability in maths", "lack of understanding of the fundamentals", "my lack of knowledge/confidence", "Lack of secure grasp of mathematics oneself", "Lack of personal attainment". Insecure subject knowledge whilst reported by the teachers to be present across the entire range is, they believe most visible at the higher levels, "Not a problem at KS1 generally" (questionnaire 2, question 2). With regard to the key stages, most felt completely confident at KS1, this declined at KS2 and again at year 7 (questionnaire 3, question 5). The teachers themselves note, "As we are an infant school we feel confident – but doubt we would cope if transferred to the next key stage", "at the higher end of the school – own knowledge of the subject", "speaking to other teachers some have expressed feelings

such as I am glad I haven't got year 6 I couldn't do it! I would attribute this to poor mathematics teaching when they were at school – taught 'tricks' not understanding" (questionnaire 2, question 2).

Subject knowledge is clearly very important, being identified as a key factor in building-up confidence. In questionnaire 1 subject knowledge was highlighted by the teachers as the most important element, alongside teaching approaches and strategies, for raising teacher confidence – more important than time for preparation; observation of good practice; pedagogy; resources; and experience (questionnaire 1, question 5). One-term post strategy implementation a different group of teachers report that subject knowledge is 'very important' for developing confidence - more important than planning and evaluating practice; lesson ideas and activities; resources; methodology; pedagogy; and experience - none believed it was 'not important' (questionnaire 2, question 4). Given these findings, it is interesting that the OISE/UT (Earl et al 2003) external evaluation of the strategies reports, "LEA informants expressed similar views to regional directors about the factors that have limited the impact of the Strategies. Consultants note for instance 'the mass of misunderstanding' and the 'lack of confidence in some teachers who feel unable to be more flexible'" (p.74).

Whilst the vast majority attribute what they report as a lack of confidence to insecure subject knowledge and their own experiences at school, some of the teachers raise additional factors alongside. Some referred to constant changes in the curriculum in recent years, an excess of change, "Another factor is the quantity of changes in the National Curriculum that we have had to cope with. This has in the past undermined morale and confidence" and "Years of changing the curriculum every few months and having no time to consolidate or reflect". Some refer to insufficient time for planning, preparation, discussion amongst colleagues and for personal professional development,

"Lack of confidence/lack of time to research and prepare for lessons", "Planning left to schools – we all re-invented the wheel with mixed results" and "Time is needed to take on-board all the materials and strategies needed. Plus time to make resources". Many refer to the need for more training, especially given limits which they report within the National Numeracy Strategy three-day training package, "training – I've learnt a lot from many courses I've been on, but not everyone has had the same opportunity" and "Historically, not enough emphasis in teacher training on mathematics in primary, including no minimum requirement of mathematics education/experience. Present day students are tested and have to reach a required standard." A sizeable number refer to the need for more guidance, discussion and support, "previously there was little guidance or structure to help teachers", "lack of advice about classroom management" and "Confidence has increased enormously mainly as a result of discussion across school". One further factor raised across several different items is the question of teacher morale and the desire to feel valued. As one teacher points out, "Many teachers feel that their own best practice is now not good enough and that there is always a better way to teach – with the introduction of the new strategy" (questionnaire 2, question 7).

9.8 What the teachers believe the impact of the National Numeracy Strategy to be with regard to building-up confidence.

The teachers welcome the National Numeracy Strategy (questionnaire 3, question 1) - despite "too many changes implemented too quickly", despite "not enough time to plan and prepare and have a life", and despite the fact that "staff needed training before it was implemented and not alongside" (questionnaire 2, question 2). They believe it to be necessary or essential, although some found it necessary but excessive

(questionnaire 1, question 15), "Everyone is finding the workload very heavy" and "Teachers are feeling overloaded by so many changes in the curriculum". This is despite the fact that "many teachers feel that their own best practice is now not good enough and that there is always a better way to teach" (questionnaire 2, question 7) and despite the fact that "Being hot on the heels of Literacy has increased workload" (questionnaire 2, question 1). Regardless of welcoming the strategy and believing it to be necessary, however, and bearing in mind the fact that only one teacher (n=46) reported that it had not increased confidence (questionnaire 3, question 4), most still believe a lack of confidence exists one-year post National Numeracy Strategy implementation (questionnaire 3, question 2).

The strategy comprised two means through which confidence could be increased - a course of training and strategy implementation itself. Most of the teachers believe that confidence increased 'a little' rather than 'a lot' as a result of strategy training (questionnaire 2, question 1a), but 'a lot' rather than 'a little' as a result of implementation (questionnaire 2, question 1b). This is further supported in the responses of the same teachers to questions 1, 7 and 8 (questionnaire 2) where they report benefit arising from implementation, "structure has been useful", "structured approach laid out", "much more focus", "I can see progression far more clearly", "good mental strategies", "contains some useful ideas", "much clearer learning objectives for mental and main part". A large number of the teachers reported that they particularly liked the mental/oral element of the strategy. Benefit from the Framework was also noted in their responses, it being as one teacher described, "a good manual, easily understood".

The responses of different teachers (questionnaire 3, question 1) following on from the focus group discussions supported this, "I liked the whole class approach to

teaching mathematics topics", "It has built up confidence in mathematics and structured my teaching", "Provides a clear structure to lesson, provides objectives for setting goals, continuity and sequence within year and from year to year – provides assessment opportunities", "Very structured – clear and helpful during QTS training", "Liked the structure of what to teach, when to teach it and plenty of ideas of how to teach it", "It provides structure and support. Tells you what to do, when to do it. How long etc", "it clarifies expectations and defines what is to be taught". As one teacher acknowledged, "I felt I needed the direction and structure to ensure I was meeting and extending the children's learning". It would appear that the teachers like the "Clear guidance" offered, the "ideas/support", the "Structured programme of what to teach when". They liked the fact that "Because it is so prescriptive – you cannot go wrong!"

The three-day training on the other hand was reported as having many shortcomings. It was "too short a time: 3 days", "too close to September 1999, that is to say training was in July 1999", "training didn't allow time to plan and/or reflect on what needed to be taught". It was "all too rushed" and presented a heavy workload, "We have given time towards this but it's meant doing about twice the amount of mathematics work (training/planning)". Research has shown that the style of training is significant. Where the training is incorrectly matched it could result in the teacher regressing rather than progressing (Irwin & Britt in Jaworski et al 1999). Limits within the cascade model are also recorded in the OISE/UT (Earl et al 2003) evaluation of the strategies, which, with regard to training and teacher capacity, acknowledges, "given the scale of the enterprise, it is not surprising that few teachers have experienced sustained and job-embedded learning. This, however, is the kind of learning necessary

for large numbers of teachers to become competent and confident about new teaching approaches and content that may be fundamentally different from past practice." (p.91)

One further factor raised holding implications in the long-term, and possibly therefore an area for further future research (see 9.10 below), concerns teacher confidence as perceived generally and reported personally. One-term post strategy implementation, twenty of the teachers (n=61) felt completely confident teaching all aspects to all classes, reception to year 7. Of that twenty, however, fifteen felt confident previously (questionnaire 2, question 10). Furthermore, whilst almost all (fifty-nine teachers, two did not respond as they were newly qualified, n=61) believed that confidence had increased generally to some degree as a result of strategy training, only forty-one of the same teachers felt their own confidence in teaching mathematics to their class had improved as a result of the same training – and ten of the forty-one qualified their answer to the smallest degree 'a little' (questionnaire 2, questions 1 & 9). This difference, between what is perceived generally and reported personally, suggests a more positive picture being presented publicly in front of colleagues. It suggests a reluctance on the part of some to display a lack of confidence openly (see 8.6 above), either in front of colleagues or even children, "Children don't miss a trick therefore some teachers must fake confidence at times!" (questionnaire 2, question 7) It also ties in with several teachers who felt reassured to discover that they were not alone, that others felt as they did, faced similar problems, and experienced similar concerns (see 9.10 below).

9.9 Reflections on this research and aspects arising.

In assessing and reflecting on this work I note several things. The first concerns my choice of research topic. I had great personal interest in this topic. It was an area

highlighted by the Numeracy Task Force and one with which I suspected teachers might identify (see 1.4 above) - desirable given workloads at the time. I felt that it might have some importance for teachers with regard to their practice and how they feel about the subject. I also suspected that some may not feel entirely confident mathematically speaking – although the scale of the problem and the strength of feeling in many cases, did surprise me. I expected this to be a very demanding topic, inquiring as it did into how teachers feel, Oppenheim (1996) notes that sensitive issues can be difficult. There were also factors that added to this difficulty, such as limits emerging within the literature and the fact that schools were particularly busy. I felt, however, that this inquiry could add to the existing knowledge base – as I believe it has. Whilst therefore the temptation if repeating this research might be to opt for a different topic, the response of several of the teachers makes me very pleased that I chose to inquire into this particular question. Indeed, those responses provide an interesting area for possible further future inquiry, discussed below.

That having been said, in retrospect there is one aspect of the research method that I would consider changing were I undertaking it again. The focus group discussions, questionnaire 2 and questionnaire 3, all provided an abundance of qualitative data, outlining a wide range of teacher opinion and highlighting several interesting issues. This proved very useful. Questionnaire 1, on the other hand, proved less fruitful. This is possibly due to the different style it adopted, which at the time seemed appropriate. With hindsight, however, its value could probably have been enhanced either by including more open-ended items or by replacing the entire questionnaire with a set of teacher interviews. Also, whilst the timing of the questionnaire was good, the data was limited as it stemmed from a very few teachers (Oppenheim 1996, Wellington 2000, Peterson 2000). By comparison, additional

qualitative data obtained prior to strategy implementation, even if from a smaller sample, could have added to the overall picture – particularly if the teachers involved subsequently answered the other questionnaires.

A weakness of this work lay in the size of the sample. As a small-scale research project it was without national significance, not aiming to draw generalisations. It sought to provide a range of opinion with regard to how the teachers herein conceptualise confidence, identifying general patterns as well as more individualistic attitudes. This I believe it has done. It also provided benefit to the author in a number of ways. First, in terms of knowledge development, both with regard to research (Entwistle & Nisbet 1976, Schumann & Presser 1982, Evans 1984, Huberman & Miles 1984, Hitchcock & Hughes 1989, Sommer & Sommer 1991, Ernest 1994, Verma & Mallick 1999) and also in the breadth of reading required, covering historical, psychological, sociological, philosophical and curricular fields. Second, it developed my research skills, particularly with regard to the drawing-up, distribution and analysis of questionnaires (Fink & Kosecoff 1985, Letiche in Day et al ed 1993, Nelson in Day et al ed 1993, Miles & Huberman 1994, Youngman in Bennett et al ed 1994, Fink 1995, Wellington 1996, Oppenheim 1996, Bell 1999, Wellington 2000, Peterson 2000). Third, it required the questioning of personal practice, a constant process from the earliest stages throughout. Finally, it gave feelings of personal enjoyment and the satisfaction of a challenge completed.

It was possible that some issues might emerge. Several did, some were incorporated into the work, others given limits in word and time, were noted as possible areas for future research. One such concerned the depth of insecurity expressed by a small number of the teachers. When asked to comment on the focus group discussions, several reported that it was "interesting", "very interesting to hear

other teachers feel the same". Others "found discussion was beneficial", "Interesting to find out from the results of the survey where other teachers worries/interests lie, and how alike the thinking in the teaching profession is" (questionnaire 3, question 9). As already noted, strength of feeling was demonstrated on some issues throughout this research. What was not visible until this point, however, was what appears to be a cry for reassurance - with regard to what these teachers think, feel and experience; a feeling of being left alone to tackle problems, or of being the only one experiencing such problems. As one teacher commented, "Interesting and reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often! That's the teaching profession!!" Several teachers conveyed milder but not dissimilar sentiments informally over coffee – nice to have time away from school to think and discuss aspects of practice, interesting to hear other people's views and ideas, reassuring to know that others feel the same, how beneficial to share concerns and ideas. As one teacher pointed out, it sometimes feels as though everyone is trying to reinvent the wheel rather than working together. A common statement expressed was the lack of time to talk or discuss, where everyone is busy. It is perhaps particularly telling to hear the word "reassuring" used, given that the dictionary defines confident as self-assured.

According to Cigman (2000) confidence is gained from overcoming fear and insecurity. The picture presented by some of these teachers is a lack of confidence reflected in feelings of being alone in facing problems, having concerns they believe others do not, putting on a brave front, portraying a more positive attitude than actually exists "teachers must fake confidence at times!" The fact that such feelings appear to be hidden rather than openly expressed would suggest that the teachers themselves are not happy to experience them, preferring to present a more confident picture. This

could go some way towards explaining why personal levels of confidence appeared lower than the level perceived generally (questionnaire 2). It could explain why several welcomed the strategy, not despite the degree of prescription but "Because it is so prescriptive – you cannot go wrong!" As one teacher commented, "Liked the structure of what to teach, when to teach it and plenty of ideas of how to teach it". It would require further research, and I am aware that this emerges from a very small group of teachers in a small-scale research project, nonetheless I am reminded of Emily (Irwin & Britt in Jaworski et al ed 1999) (see 4.3 above) amongst others - "Interesting and reassuring to find out that I am not alone and that many teachers feel the same although it's a pity they don't admit this very often! That's the teaching profession!!", "Interesting to find out from the results of the survey where other teachers worries/interests lie, and how alike the thinking in the teaching profession is", "I find it difficult to cope with teaching more than one objective in a lesson. Some teachers/pupils find the mental calculations threatening – why can't we write it down!", "Children don't miss a trick therefore some teachers must fake confidence at times!"

Appendix i:

Questionnaire 1: Mathematics in Primary Schools.

(Circle that which **most** applies. Completion time, approximately 5 minutes.)

1. Would you feel completely confident teaching all aspects of mathematics outlined in the National Curriculum at -

KS1: all aspects / some aspects / hardly any aspects
KS2: all aspects / some aspects / hardly any aspects
YEAR 7: all aspects / some aspects / hardly any aspects

2. Would you feel completely competent teaching all aspects of mathematics required by the National Curriculum at -

KS1: all aspects / some aspects / hardly any aspects
KS2: all aspects / some aspects / hardly any aspects
YEAR 7: all aspects / some aspects / hardly any aspects

3. From your experience, are confidence and competence in mathematics teaching linked?

not at all / a little / a lot

4. Circle those areas in which you do not feel completely confident and competent.

KS1: Using & applying maths; Number; Shape, space & measures.
KS2: Using & applying maths; Number; Shape, space & measures; Handling data.
YEAR 7: Using & applying maths; Number; Shape, space & measures; Handling data.

5. Which do you feel is important for developing teacher confidence and competence in mathematics? (Number 1-3: 1 = very important, 2 = important, 3 = of little importance)

[..] greater mathematical subject knowledge
[..] a broader range of approaches and strategies
[..] observing experienced/effective teachers teach
[..] working in-class with an effective teacher/coordinator
[..] experience of teaching mathematics to different age ranges
[..] more resources, text books, work sheets, teacher books
[..] support from the coordinator in planning/evaluating
[..] greater knowledge of the pedagogy of teaching mathematics
[..] more time within the school day for lesson preparation
[..] other _____

6. Rate in-service training according to its effectiveness in developing mathematical confidence and competence in the teacher. (Number 1-3: 1 = very important, 2 = quite useful, 3 = of little use)

[..] school INSET held after school
[..] non-pupil days
[..] short-term external courses (one day or less)
[..] long-term external courses (over a number of weeks)
[..] P/T modular Master degree courses (eg MEd, MA)
[..] other _____

7. How do you rate your initial teacher training as a preparation for mathematics teaching in terms of developing -

subject knowledge	(very good / quite good / poor)
teaching approaches	(very good / quite good / poor)
class management	(very good / quite good / poor)
lesson planning	(very good / quite good / poor)
pupil assessment	(very good / quite good / poor)
pedagogy	(very good / quite good / poor)
competence	(very good / quite good / poor)
confidence	(very good / quite good / poor)
philosophy	(very good / quite good / poor)

8. From your experience do students on final practice generally demonstrate a high level of confidence/competence in mathematics?

yes / no / do not know / in some areas eg._____

9. Has implementing the National Curriculum altered your beliefs and values concerning mathematics education?

not at all / a little / a lot

10. Has implementing the National Curriculum altered the <u>way</u> in which you teach mathematics (rather than <u>what</u> you teach)?

not at all / a little / a lot

11. Do you feel that curricular changes in primary mathematics (Mathematics in the National Curriculum) since 1989 have been

unnecessary / necessary / essential / necessary but excessive

12. Why do you believe the National Numeracy Strategy is being introduced? (Tick as many as you feel appropriate.)

[..] to raise pupil standards
[..] to improve teacher standards
[..] to replace Mathematics in the National Curriculum
[..] for political reasons
[..] other_____

13. Do you feel that standards of pupil achievement in mathematics have declined since you started teaching?

yes / no / the same / do not know / in some areas eg._____

14. Do you expect, based upon knowledge to date, the Numeracy Strategy to change <u>how</u> you teach (rather than <u>what</u> you teach)?

not at all / a little / a lot

15. Do you think that the National Numeracy Strategy is generally

unnecessary / necessary / essential / necessary but excessive

16. In which subjects do you feel strongest? (1= most confident)

....English ....Science ....Mathematics ....ICT ....Geography
....History ....Music ....Art ....Design & Technology ....PE

17. General information on your career since completing initial teacher training:

Qualifying year & length of service? _____
Qualifications? _____
Subject responsibilities? _____
Present year group (duration)? _____
Other year groups taught (duration)? _____
Type of school? _____
NNS training (type/duration)? _____
Other maths courses? _____
Other relevant information? _____

Appendix ii:

Questionnaire 1: Teacher responses - (n = 30)

1. Would you feel completely confident teaching all aspects of mathematics outlined in the National Curriculum at -
(A = all aspects, B = some aspects, C = hardly any aspects, D = did not respond to this item)

	A	B	C	D
KS1:	24	3	1	2
KS2:	12	12	2	4
YEAR 7:	5	9	10	6

2. Would you feel completely competent teaching all aspects of mathematics required by the National Curriculum at -
(A = all aspects, B = some aspects, C = hardly any aspects, D = did not respond to this item)

	A	B	C	D
KS1:	25	3	0	2
KS2:	14	*9*	2	5
YEAR 7:	3	11	9	7

3. From your experience, are confidence and competence in mathematics teaching linked?

not at all	0
a little	6
a lot	24

4. Circle those areas in which you do not feel completely confident and competent.
(A = Using & applying mathematics, B = Number, C = Shape, space & measures, D = Handling data)

	A.	B.	C.	D.
KS1:	3	0	2	n/a
KS2:	4	5	2	2
YEAR 7:	9	8	5	6

5. Which do you feel is important for developing teacher confidence and competence in mathematics? (A = very important, B = important, C = of little importance, D = did not respond to this item)

	A	*B*	*C*	*D*
Greater mathematical subject knowledge	20	9	1	0
A broader range of approaches & strategies	20	7	3	0
Observing experienced/effective teachers teach	11	18	1	0

Working in-class with an effective teacher/coordinator	11	18	1	0
Experience of teaching maths to different age ranges	3	20	7	0
More resources, text books, work sheets, teacher books	7	15	8	0
Support from the coordinator in planning/evaluating	9	17	4	0
Greater knowledge of the pedagogy of teaching maths	8	13	9	0
More time within the school day for lesson preparation	13	11	6	0

6. Rate in-service training according to its effectiveness in developing mathematical confidence and competence in the teacher. (A = very important, B = quite useful, C = of little use, D = did not respond to this item)

	A.	B.	C.	D
School INSET held after school	4	21	5	0
Non-pupil days	17	11	0	2
Short-term external courses (one day or less)	9	17	1	3
Long-term external courses (over a number of weeks)	11	11	5	3
P/T modular Master degree courses (eg MEd, MA)	2	14	11	3

7. How do you rate your initial teacher training as a preparation for mathematics teaching in terms of developing -

	very good	quite good	poor	did not respond
Subject knowledge	4	12	13	1
Teaching approaches	2	12	14	2
Class management	4	8	16	2
Lesson planning	4	14	10	2
Pupil assessment	1	9	18	2
Pedagogy	2	15	12	1
Competence	2	15	10	3
Confidence	2	15	11	2
Philosophy	2	17	10	1

8. From your experience do students on final practice generally demonstrate a high level of confidence/competence in mathematics?

yes	3
no	8
do not know	5
in some areas	11
did not respond to this item	3

9. Has implementing the National Curriculum altered your beliefs and values concerning mathematics education?

not at all	6
a little	16

a lot	2
did not respond to this item	6

10. Has implementing the National Curriculum altered the <u>way</u> in which you teach mathematics (rather than <u>what</u> you teach)?

not at all	6
a little	13
a lot	5
did not respond to this item	6

11. Do you feel that curricular changes in primary mathematics (Mathematics in the National Curriculum) since 1989 have been

unnecessary	1
necessary	11
essential	5
necessary but excessive	9
n/a	4

12. Why do you believe the National Numeracy Strategy is being introduced? (Tick as many as you feel appropriate.)

to raise pupil standards	29
to improve teacher standards	22
to replace Mathematics in the National Curriculum	3
for political reasons	22

13. Do you feel that standards of pupil achievement in mathematics have declined since you started teaching?

yes	4
no	16
the same	5
do not know	4
in some areas	1

14. Do you expect, based upon knowledge to date, the Numeracy Strategy to change <u>how</u> you teach (rather than <u>what</u> you teach)?

not at all	1
a little	15
a lot	14

15. Do you think that the National Numeracy Strategy is generally

unnecessary	0
necessary	17
essential	6
necessary but excessive	5
did not respond to this item	2

16. In which subjects do you feel strongest? (1= most confident)
Where teachers numbered 1-10, A=1-3, B=4-6, C=7-10, D=no number given
Where teachers numbered 1-3, A=1, B=2, C=3, D=no number given.

	A	*B*	*C*	*D*
English	27	3	0	0
Science	14	9	5	2
Mathematics	11	14	3	2
ICT	9	7	11	3
Geography	10	14	4	2
History	7	15	7	1
Music	6	10	10	4
Art	8	13	7	2
Design Technology	8	8	11	3
PE	12	8	9	1

17. General information on your career since completing initial teacher training:

Qualifying year –	Pre NC	19
	Post NC	11
Qualifications –	Masters degree	3
	Bachelor degree	22
	Cert/Diploma	6
Subject responsibility for maths –		8
Year groups taught –	Reception / KS1	22
	KS2	23
	Year 7	10
NNS training -	INSET days	11
	3-day training course	8
	None	5

Appendix iii:

Questionnaire 2: The National Numeracy Strategy in Primary Schools.

Circle that which most applies but please feel free to add comments or give examples. There is no requirement to supply your name but if given, no names or schools will be identified. Completion time, 6 minutes approximately. Thank you.)

1. *"We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy."(Final Report of the Numeracy Task Force, DfEE 1998)*

Given this focus, do you believe that, generally speaking -

a. teacher confidence in mathematics has increased as a result of NNS training?

not at all / a lot / a little eg._____

b. teacher confidence in mathematics has increased as a result of NNS implementation?

not at all / a lot / a little eg _____

c. NNS training has adequately prepared teachers for NNS implementation?

yes / no / in some areas eg _____

d. pupil achievement, interest and enjoyment have improved as a result of the NNS?

not at all / a lot / a little eg_____

2. Given this focus, do you believe there is a lack of teacher confidence generally in the teaching of mathematics, and if so, to what would you attribute it?

3. Were any aspects omitted or insufficiently addressed in NNS training, which you feel are important to teachers and to the successful implementation of the strategy?

4. How important do you feel the following are for developing and increasing teacher confidence generally?

subject knowledge	very important / quite important / not important
methodology	very important / quite important / not important
pedagogy	very important / quite important / not important
lesson ideas & activities	very important / quite important / not important

class management/organization	very important / quite important / not important
resources	very important / quite important / not important
planning & evaluating practice	very important / quite important / not important
experience	very important / quite important / not important

5. How effective do you feel the NNS has been with regard to increasing teacher

knowledge of the Framework	very effective / quite effective / not effective
curriculum & policy knowledge	very effective / quite effective / not effective
subject knowledge	very effective / quite effective / not effective
methodology	very effective / quite effective / not effective
pedagogy	very effective / quite effective / not effective
lesson ideas and activities	very effective / quite effective / not effective
class management/organization	very effective / quite effective / not effective
planning & evaluating practice	very effective / quite effective / not effective

6. How would you define confident teaching in mathematics?

7. How do you believe teacher confidence affects practice?

8. Regarding the NNS -

Are you implementing it in your practice?	yes / no
Were you a pilot school?	yes / no
Has implementing it altered your values and beliefs?	yes / no
Has implementing it improved your practice? If so, how?	yes / no

eg. _____

9. Regarding NNS training –

How many hours training have you had?
What further training are you expecting?
Has training increased your confidence in teaching mathematics to your class?

10. Would you, post NNS training (received to date) and implementation, feel completely *confident* teaching all aspects of the curriculum to all classes from reception to year 7, if necessary?

yes (but was confident prior to NNS)
yes (was less confident prior to NNS)
mostly confident (not in certain aspects eg _____)

mostly confident (not at certain key stages eg_____)
not completely confident in mathematics

11. From your experience, what course of action do you feel would most help increase teacher confidence generally in mathematics?

12. How would you rate the effectiveness of the following as a means of increasing mathematical confidence in teaching?
(Number 0-3: 1=very effective 2=quite effective 3=not effective 0=no experience)

____ Initial training
____ INSET
____ NNS training
____ NNS implementation
____ Mathematics in the National Curriculum
____ Literature
____ Research
____ Mathematics coordinators
____ Colleagues
____ Experience
____ Personal dedication, time & effort
____ Other_____

13. Do you feel that teaching effectiveness in mathematics has improved generally as a result of the NNS?

not at all / a lot / a little / in some aspects eg _____

14. Are there any other comments you would like to make on NNS training, implementation, or teacher confidence?

Appendix iv:

Questionnaire 2: Teacher responses – (n = 61)

1. *"We have focused in particular on the need to build up teachers' confidence and competence as quickly as possible at the beginning of the strategy."(Final Report of the Numeracy Task Force, DfEE 1998)*

Given this focus, do you believe that, generally speaking -

a. teacher confidence in mathematics has increased as a result of NNS training?

not at all	1
a lot	24
a little	35
did not respond to this item	1

b. teacher confidence in mathematics has increased as a result of NNS implementation?

not at all	5
a lot	29
a little	26
did not respond to this item	1

c. NNS training has adequately prepared teachers for NNS implementation?

yes	18
no	8
in some areas	34
did not respond to this item	1

d. pupil achievement, interest and enjoyment have improved as a result of the NNS?

not at all	3
a lot	32
a little	24
did not respond to this item	2

2. Given this focus, do you believe there is a lack of teacher confidence generally in the teaching of mathematics and if so, to what would you attribute it?

yes	45
no	9
not at KS1	3
neither	4

4. How important do you feel the following are for developing and increasing teacher confidence generally?
(A = very important, B = quite important, C = not important, D = did not respond to this item)

	A.	B.	C.	D.
Subject knowledge	49	11	0	1
Methodology	37	20	2	2
Pedagogy	23	30	3	5
Lesson ideas & activities	47	12	1	1
Class management /organization	43	15	2	1
Resources	37	23	0	1
Planning & evaluating practice	48	10	2	1
Experience	15	39	6	1

5. How effective do you feel the NNS has been with regard to increasing teacher
(A = very effective, B = quite effective, C = not effective, D = did not respond to this item)

	A.	B.	C.	D.
Knowledge of the Framework	16	31	2	2
Curriculum & policy knowledge	9	37	12	3
Subject knowledge	18	35	6	1
Methodology	15	39	5	2
Pedagogy	9	41	6	5
Lesson ideas & activities	10	37	13	1
Class management /organization	11	34	14	2
Planning & evaluating practice	16	32	10	3

8. Regarding the NNS –

	Yes.	No.	Did not respond
Are you implementing it in your practice?	61	0	0
Were you a pilot school?	10	51	0
Has implementing it altered your values & beliefs?	25	35	1
Has implementing it improved your practice?	52	7	2

9. Has training increased your confidence in teaching mathematics to your class?

Yes	31
no	15
a little	10
questionable	1
did not respond to this item	3
n/a	1

10. Would you, post NNS training (received to date) and implementation, feel completely *confident* teaching all aspects of the curriculum to all classes from reception to year 7, if

necessary? (Some of the teachers ticked more than one option, to include a certain key stage or certain aspects.)

yes (but was confident prior to NNS)	15
yes (was less confident prior to NNS)	5
mostly confident (not in certain aspects)	3
mostly confident (not at certain key stages)	30
not completely confident in mathematics	9

12. How would you rate the effectiveness of the following as a means of increasing mathematical confidence in teaching?
(A=very effective B=quite effective C=not effective D=no experience E=did not respond to this item)

	A.	B.	C.	D.	E.
Initial training	12	31	8	6	4
INSET	26	32	1	0	2
NNS training	11	40	8	0	2
NNS implementation	25	30	3	0	3
Mathematics in the NC	5	32	19	2	3
Literature	4	27	22	2	6
Research	3	23	22	8	5
Mathematics coordinators	22	26	4	0	9
Colleagues	22	29	5	0	5
Experience	20	31	4	1	5
Personal dedication, time & effort	31	20	5	0	5

13. Do you feel that teaching effectiveness in mathematics has improved generally as a result of the NNS?

not at all	0
a lot	26
a little	19
in some aspects	14
don't know	2

Appendix v:

Questionnaire 3:

1. Did you welcome the National Numeracy Strategy and if so why? Yes / no

2. Do you feel there is a lack of teacher confidence generally in mathematics? Yes / no

3. Is confidence important to you in terms of your –
a. mathematics teaching? Yes / no
b. how you perceive yourself as a mathematics teacher? Yes / no

4. Has the National Numeracy Strategy increased your –
a. mathematical confidence? Yes / no
b. mathematical competence? Yes / no
c. enjoyment of the subject? Yes / no

5. Would you now feel completely confident teaching all aspects of the mathematics curriculum at each of the following levels?

a. KS1 Yes / no / felt completely confident already
b. KS2 Yes / no / felt completely confident already
c. year 7 Yes / no / felt completely confident already

6. Do you feel you need to increase your confidence with regards to your –

a. teaching of mathematics? Yes / no
b. subject knowledge? Yes / no
c. implementing of the NNS? Yes / no
d. implementing the Revised Curriculum? Yes / no

7. Is more mathematics training needed and if so in what area? Yes / no

8. How would you describe yourself (please tick as many as are applicable)?
Head teacher
Mathematics coordinator
Class teacher
Experience of: KS1 / KS2 / year 7 / SEN
Year of qualifying:

(I would also welcome any comments you wish to make overleaf regarding the NNS, teacher confidence and mathematics teaching.)

9. How would you evaluate this session?

Appendix vi:

Questionnaire 3: Teacher responses – (n = 46).

1. Did you welcome the National Numeracy Strategy?

Yes	44
No	0
Newly qualified	2

2. Do you feel there is a lack of teacher confidence generally in mathematics?

Yes	35
No	9
Did not respond to this item	2

3. Is confidence important to you in terms of your –

a. mathematics teaching?	Yes	45
	No	0
	Did not respond	1

b.how you perceive yourself as a mathematics teacher?

	Yes	41
	No	0
	Did not respond	5

4. Has the National Numeracy Strategy increased your –

a. mathematical confidence?	Yes	43
	No	1
	Did not respond	2
b. mathematical competence?	Yes	43
	No	1
	Did not respond	2
c. enjoyment of the subject?	Yes	39
	No	4
	Did not respond	3

5. Would you now feel completely confident teaching all aspects of the mathematics curriculum at each of the following levels?
(A = Yes, B = no, C = felt completely confident already, D = did not respond to this item)

	A.	B.	C.	D.
KS1	26	11	8	1
KS2	22	20	3	1

Year 7	8	34	2	2

6. Do you feel you need to increase your confidence with regards to your –

a. teaching of mathematics?	Yes	20
	No	20
	Did not respond	6
b. subject knowledge?	Yes	26
	No	15
	Did not respond	5
c. implementing of the NNS?	Yes	25
	No	17
	Did not respond	4
d. implementing the Revised Curriculum?	Yes	27
	No	16
	Did not respond	3

7. Is more mathematics training needed?	Yes	39
	No	4
	Did not respond	3

8. How would you describe yourself?

Head teacher	2
Mathematics coordinator	20
Class teacher	24
KS1	33
KS2	28
Year 7	2
SEN	6
Qualified pre-1989	20
Qualified post 1989	19
Did not respond to this item	7

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